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23

EXTRACTS OF PAPERS

RELATIVE TO THE

REVENUE OF THE

STATE OF

NEW YORK

FOR THE YEAR

1850

AND THE

REVENUE

EXTRACTS OF PAPERS

Printed and Manuscript,

LAID BEFORE THE COMMISSION APPOINTED TO CONSIDER THE STEPS TO BE TAKEN

FOR

RESTORATION

OF

THE STANDARDS OF WEIGHT AND MEASURE,

AND THE SUBJECTS CONNECTED THEREWITH.

ARRANGED BY G. B. AIRY, Esq., ASTRONOMER ROYAL.

PRINTED BY ORDER OF THE LORDS COMMISSIONERS OF THE TREASURY.

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MDCCCLXI.



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AND THE SUBJECTS CONNECTED THEREWITH

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MEMBERS OF THE COMMISSION.

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In consequence of the lamented death of Mr. GILBERT, during the sitting of the Commission, it has appeared desirable to include, in the following Extracts, the letters addressed by Mr. GILBERT to Mr. AIRY, on the subjects to which the investigations of the Commission were directed.

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EXPLANATION OF REFERENCES TO WRITERS AND WORKS QUOTED
IN THE FOLLOWING EXTRACTS.

Austrian Papers.

A Collection of Manuscript Papers, principally in the German language, transmitted by the Austrian Government to the British Embassy at Vienna.

BAILY's Standard.

Report on the New Standard Scale of the Royal Astronomical Society, in the Mem. R. Ast. Soc., vol. ix. by Francis Baily, Esq., V. P. R. S. and R. A. S. (one of the Members of the Standard Commission).

MESSRS. BARRETT and CLAY.

Wine and Spirit Merchants, 70, Mark Lane; in letter to Mr. Airy.

MR. BARRY.

Mr. J. T. Barry, of the firm of Allen and Barry, Manufacturing Chemists, Plough-court, Lombard-street; in letter to Mr. Airy.

Base du Système Métrique.

The well-known French work, containing the geodetic and other details on which the French Metrical System is founded.

MR. BATE.

Mr John Bate, Instrument-maker, Poultry; in letter to Mr. Airy.

BELFAST INSPECTOR.

Answers by the Inspector of Weights and Measures, Belfast, to a series of Questions transmitted by Mr. Airy to the Chamber of Commerce, Belfast.

M. BESSEL.

Director of the Observatory of Königsberg, Prussia; in letter to Mr. Airy.

BESSEL's Standard.

Darstellung der Untersuchungen und Maasregeln welche, in den Jahren 1835 bis 1838, durch die Einheit des Preussischen Langenmaasses veranlasst worden sind, von F. W. Bessel (Berlin, 1839).

MR. BIDDELL.

Mr. Arthur Biddell, Farmer and Land-agent, of Playford, near Ipswich; in letter to Mr. Airy.

Mr. BINGLEY.

Of the Assay-office, in verbal communication with Mr. Baily.

Mr. BLACKBURN.

Mr. Isaac Blackburn, Scale-maker, 126, Minories ; in letter to Mr. Lubbock.

Mr. BOWEN.

John Bowen, Esq., Superintendant of Office of Weights and Measures, Exchequer ; in letter to Mr. Airy.

Mr. BRIGHT.

Mr. Brailsford Bright, of the firm of Hearon, Bright, and Co., Wholesale Druggists, 95, Bishopsgate-street ; in letter to Mr. Charles May.

Mr. BROWNE.

Mr. Barwell Browne, of the firm of Browne and Wingrove, Melters of Bullion, &c., Wood-street ; in letter to Mr. Airy.

Mr. CARRUTHERS.

P. Carruthers, Esq., Exchequer ; in letter to Mr. Airy.

Mr. CHAPMAN.

Mr. Thomas Chapman, connected with the firm of Horner and Son, Wholesale Druggists, 20, Bucklers-bury ; in letter to Mr. Charles May.

Mr. CHILD.

Mr. James Child, Inspector of Weights and Measures, Amwell-street, Clerkenwell ; in letter to Mr. Airy.

Mr. CLAXTON.

William Claxton, Esq., Corn Merchant, Liverpool ; in letter to Mr. Bethune.

Col. COLBY.

Col. Colby, R. E., Director of the Trigonometrical Survey of Great Britain and Ireland, in evidence given before the Commission, and in letter to Mr. Airy.

Connaissance des Temps.

The French official Almanac, so named.

Mr. CUBITT.

William Cubitt, Esq., Civil Engineer, 6, Great George Street ; in letter to Mr. Airy.

Capt. DAWSON.

Captain R. Dawson, R. E., Surveyor to the Tithe Commissioners ; in evidence given before the Commission.

Mr. DE GRAVE.

Mr. E. A. De Grave, Scale-maker, 59, St. Martin-le-Grand ; in letter to Mr. Airy.

Mr. DE MORGAN.

Augustus De Morgan, Esq., Professor of Mathematics in University College, London ; in letter to Mr. Airy.

Mr. EDEN.

Arthur Eden, Esq., Assistant-Comptroller of the Exchequer ; in letter to Mr. Airy.

Mr. EXLEY.

Rev. Thomas Exley, 17, Portland-street, Bristol ; in letter to the President of the Chamber of Commerce, Bristol.

Mr. FIELD.

Mr. Joshua Field, of the firm of Maudslays and Field, Engineers, Lambeth ; in letter to Mr. Airy.

Mr. GILBERT.

Davies Gilbert, Esq., formerly M. P., and President of the Royal Society, and Member of the Royal Commission on Weights and Measures in the year 1823 ; Member of the present Commission ; in letter to Mr. Airy.

Mr. GINGELL.

Mr. W. J. Gingell, Inspector of Weights and Measures for the City of Bristol ; in letter to Mr. Airy.

GLASGOW COMMITTEE.

Report of the Committee of the Directors of the Chamber of Commerce and Manufactures of Glasgow, appointed to consider the Bill now [1823] before Parliament for establishing uniformity of Weights and Measures ; and a similar Report 1834 ; transmitted by the Chamber of Commerce to Mr. Airy.

Mr. GODFREY.

Edward Godfrey, Esq., of East Bergholt, near Ipswich, Chairman to the Ipswich Bench of Magistrates ; in answer to questions transmitted by Mr. Airy.

Mr. HAGGARD.

W. D. Haggard, Esq., of the Bullion Office, Bank of England ; in evidence given before the Commission ; and in letter to Mr. Airy.

Mr. HARLEY.

Edward Harley, Esq., President of the Chamber of Commerce, Bristol ; in answer to questions transmitted by Mr. Airy.

Mr. HASSLER.

Comparison of Weights and Measures of Length and Capacity reported to the Senate of the United States by the Treasury Department in 1832, and made by Ferdinand Robert Hassler. (Washington, 1832.)

Dr. HAVILAND.

John Haviland, Esq., M. D., Regius Professor of Medicine in the University of Cambridge ; in letter to Mr. Airy.

Mr. HAYMAN.

Mr. James Hayman, corn-merchant and manufacturer of corn-measures, 27, Mount-street, Lambeth ; in letter to Mr. Airy.

Mr. HOWLETT.

Samuel B. Howlett, Esq., Chief Draftsman in the Royal Engineer Department ; in Report to the Inspector General of Fortifications, transmitted by the Master-General and Board of Ordnance to the Chancellor of the Exchequer.

L'Institut.

The French scientific newspaper, so entitled.

Rev. R. JONES.

One of the Commissioners for the Commutation of Tithes in England and Wales; in letter to Mr. Airy.

Mr. JUGGINS.

Mr. W. Juggins, of 22, James Street, Covent Garden: constructor of porcelain weights and weighing-plates; in letter to Mr. Airy.

Captain KATER.

Account of the new Standards of Weights and Measures; Phil. Trans., 1826.

Dr. LAMONT.

Director of the Observatory of Bogenhausen, near Munich; in letter to Mr. Airy.

Signor LANA.

Inspector of Weights and Measures, of Turin; in letter to Mr. Airy.

Mr. MAY.

Mr. Charles May, Engineer, Ipswich, and of the firm of May and Allen, Drug-grinders and Manufacturing Chemists, 7, Cowper street, City-Road; in letter to Mr. Airy.

Professor MILLER.

W. H. Miller, Esq., Fellow of St. John's College, and Professor of Mineralogy in the University of Cambridge; in letter to Mr. Airy.

Count MOLÉ.

Minister of France; in letter to the English Embassy.

Professor MOLL.

Comparison of Standards of the Troy Pound; in the Journal of the Royal Institution, No. 4, 1831.

Mr. PARKER.

Description of a new Quart and Bushel Measure, &c., by T. N. Parker, Esq., A. M. (Shrewsbury, 1839).

Colonel PASLEY.

Observations on the Expediency and Practicability of simplifying and improving the Measures, Weights, and Money, &c., by C. W. Pasley, C. B., Colonel in the Corps of Royal Engineers. (London, 1834).

Mr. PELLATT.

Mr. Apsley Pellatt, of the Falcon Glass Works, Holland-street, Blackfriars; in letter to Sir J. F. W. Herschel.

Prussian Law.

Maass-und Gewicht-Ordnung für die Preussischen Staaten. Vom 16ten Mai, 1816. (Printed in the Gesetz-Sammlung für die Königlichen Preussischen Staaten).

Prussian Law Instructions.

Anweisung zur Verfertigung der Probemasse und Gewichte, &c. (Printed in the same).

M. QUETELET.

Director of the Observatory at Brussels ; in letter to Mr. Airy.

Mr. REEVES.

Mr. H. P. Reeves, Inspector of Weights and Measures, 8, Castle-street, Bloomsbury ; in letter to Mr. Airy.

Mr. REYNOLDS.

Mr. Thomas Reynolds, Inspector of Weights and Measures, 28, Brick-lane ; in letter to Mr. Airy.

Dr. ROGET.

Peter Mark Roget, Esq., M. D., Secretary of the Royal Society ; in evidence given before the Commission, and in letter to Mr. Airy.

Russian Papers.

Communication from the Russian Government to the English Embassy at St. Petersburg.

Sardinian Laws.

Manifesto della Regia Camera de' Conti, portante notificazione del nuovo Regolamento approvato da S. M. per li pesi e misure. In data del 29 Luglio, 1826.

M. SCHUMACHER.

Director of the Observatory of Altona ; in letter to Mr. Airy.

Mr. SHARP.

Mr. Granville Sharp, of the firm of J. G. and G. A. Sharp, Bullion-brokers, 31, Winchester-street ; in evidence given before the Commission, and in letter to Mr. Airy.

Mr. SIMMS.

Mr. William Simms, of the firm of Troughton and Simms, Opticians and Instrument-makers, 136, Fleet-street ; in letter to Mr. Airy.

Mr. THOMSON.

Mr. T. S. Thomson, Manufacturing Chemist, of Primrose, near Clitheroe ; in letter to Peter Ewart, Esq.

TUREN ACADEMY.

Parere della Reale Accademia delle Scienze di Torino, intorno alle Misure ed ai Pesi.

Mr. WADE.

Mr. John Wade, Inspector of Weights and Measures, Union-street, Southwark ; in letter to Mr. Airy.

Mr. WALKER.

James Walker, Esq., Civil Engineer, 23, Great George-street ; in letter to Mr. Airy.

Messrs. WARNER.

Messrs John Warner and Sons, Scale-makers, 8, Crescent, Cripplegate ; in letter to Mr. Airy.

Westminster Review.

Article on Weights and Measures in the Westminster Review, No. 31, January, 1832.

Messrs. WHITBREAD.

Messrs. Whitbread & Co. Brewers, Chiswell-street ; in letter to Mr. Airy.

Page 1108, line 16, *for* 1840, *read* 1816.

SECTION A.

EXTRACTS RELATING TO THE BASIS (ARBITRARY OR NATURAL) TO BE ADOPTED FOR THE DEFINITION AND RESTORATION OF STANDARDS OF WEIGHT AND MEASURE.

A. 1. *Austrian Papers.*

The unit of the Austrian weight is the Vienna pound, equal to 560.012 grammes.

A. 2. Mr. BARRY.

I should say that the advantage of a simple relation between capacity and weight, is particularly found in the facility which it gives for determining with exactness the imperial measure (not in cubic feet, but in gallons, &c.) of any liquor from its ascertained total weight and its specific gravity. The operation of gauging is acknowledged to be an imperfect way of ascertaining the volume of fluid in a cask, owing in part to the unequal thickness of its staves; on this account, the gauge quantity is considered often as scarcely an approximation within one per cent. of the true quantity.

A. 3. Mr. BARRY.

It is very convenient that the gallon of water should weigh exactly 10 lbs. [avoirdupois].

No material convenience could result from causing the cubic foot of water to represent exactly 1000 ounces.

A. 4. BESSEL's *Standard.*

The Prussian law declares that the standard shall be 139.13 French lines; at the same time it declares that the standard, when constructed, shall be the only standard of length. It is evident here that the former provision declares the guiding intention of the law, which is to be fulfilled in the construction of a new standard of 1837, whether that of 1816 have fulfilled it or not.

A. 5. BESSEL's *Standard.*

It is true that the length of a standard is arbitrary; nevertheless, in forming a new standard, there was no intention of changing the length. The most important things were, to remove uncertainty; to construct an efficient standard requiring no further reference to a foreign measure; to provide efficiently against the causes of change incidental to its uses; and to provide for multiplication of standards. The last of these was one of the most important; it will be best fulfilled by adopting methods for the multiplication, which are very easy, and, at the same time, very accurate.

A. 6. Mr. EXLEY.

A standard length should be fixed on, such as determined by the length of a seconds' pendulum, or the length of a degree at a given place of latitude; and the unit of length being settled, the unit of area should be its square, and that of capacity its cube.

A. 7. Mr. GILBERT.

The pendulum involves so many difficulties in respect to the determination of its exact length, that our reference must be to one having all its minute circumstances detailed, as to substance, bearing on knife-edges, &c.

It having been shewn by Sir Isaac Newton that a resisting medium does not affect the time of vibration, and Kater having applied the principle of convertibility between the axis of suspension and a parallel line passing through the centre of oscillation, I really expected the most accurate results. With a given length, the time is as the square root of inertia directly, and as the square root of gravity inversely; and inertia being supposed constant, the correction for buoyancy was quite obvious; but now it seems that inertia is variable, in consequence of air adhering to a body in motion, and probably differing in quantity for different materials and for different degrees of smoothness.

A. 8. Mr. GILBERT.

I think that the new standards should be made as nearly as possible equal to the former, without any regard to geodetic measures, or to the pendulum, in the first instance, but that the ratios should be given.

A. 9. Mr. GILBERT.

Several standards should be constructed—three at the least—and their authenticity established on the principle of heirship. One might be preserved at the Observatory, one in the British Museum, and one at the Tower.

A. 10. Mr. GILBERT.

The natural process of deriving standards from each other seems to be obviously this:—

Abstract lengths.

Superficies.

Abstract capacities, for measures.

Capacities, filled with some concrete substance (water), give weights.

Making weights the primary standard would not only invert the natural order, but would be further inexpedient from involving specific gravities in the first instance.

A. 11. Mr. GILBERT.

I fear that the standard of weight must be arbitrary; to be connected with linear measures through the medium of water; and these standards should be multiplied in the same manner as those of lengths.

A. 12. Mr. GILBERT.

I presume that we cannot come to any other conclusions than these two:—

That the models be re-established in duplicate, or still better, in triplicate; to be deposited in different places of the utmost safety, with an heirship among them.

And that everything be left exactly as it is.

A. 13. GLASGOW COMMITTEE.

They would humbly recommend the adopting the Exchequer gallon of 270 cubic inches.

A. 14. GLASGOW COMMITTEE.

The pound avoirdupois is defined to be 7000 grains, and consequently the ounce $437\frac{1}{2}$ grains. But if the pound were to be made 6,980 grains, or, more exactly, 6,979.959 grains, then 1000 ounces, or $62\frac{1}{2}$ pounds, of rain water at 62° of temperature, would be precisely equal in bulk to one cubic foot; and 10,000 ounces, or 625 pounds, of such water equal in bulk to one

A. 14. GLASGOW COMMITTEE—*continued*.

quarter. Weights and measures would then be connected by a simple ratio, and a facility given to the calculating the cubical contents of cylinders, and correct data obtained for the construction of cylindrical measures.

A. 15. DR. LAMONT.

I will not omit here to suggest that there are means of connecting long measure with the phenomena of solar light (Fraunhofer's lines), in such a manner that, in any part of the globe, the absolute length, for instance, of the English foot, could be obtained independent of the standard, by means of the instruments usually employed in making exact physical experiments. Establishing a proportion between the standard and the dimensions of the earth, or the seconds' pendulum, has hitherto afforded no real advantage for science or for the ordinary purposes to which mensuration is applied; and it may be reasonably doubted whether such advantage will be afforded hereafter.

A. 16. DR. LAMONT.

The object of the Bavarian Government in changing the weights and measures in 1809, was to substitute one uniform system for the numerous and different systems then employed in the different towns and districts of the kingdom. The new system is merely a *definition*, establishing a certain proportion between the French and Bavarian weights and measures. Bavaria has no standards, in the proper sense of the word. The original weights and measures made after the French standard, and now preserved at the Mint, have no legal value.

A. 17. DR. LAMONT.

The Bavarian foot is equal to 129.38 Paris lines.

The Maass-kann, or Maass (the unit of liquid measure), is equal to 43 decimal cubic inches (Bavarian).

The Bavarian pound is equal to 560 grammes.

A. 18. DR. LAMONT.

I do not find that the Bavarian Commission of weights and measures expressed any desire of introducing an independent basis of the system, or that they made any propositions concerning the necessity or means of making, preserving, or restoring, in case of loss, the exact standard of weights and measures. As the law stands, an exact copy of the Bavarian weights and measures can be obtained only by direct comparison with the French standards: and though the original weights and measures preserved at the Mint are looked upon and used as standards, yet they are not legally defined to be so.

A. 19. SIGNOR LANA.

The standard actually in use (in the Sardinian States) is the foot called formerly Liprando, now called the Piedmontese, in pursuance of the recommendation of the Academy of Turin, dated 19th May, 1816. This foot corresponds to 1" of a mean degree of terrestrial meridian.

From the Piedmontese foot is deduced the Piedmontese pound of 12 ounces, by assuming the weight of a cube whose sides are $\frac{1}{3}$ of a foot, filled with distilled water at the temperature + 4° centigrade, to be 164 ounces.

A. 20. SIGNOR LANA.

The Sardinian standards have been compared with the metre and the chilogramme.

A. 21. Signor LANA.

No change has been made in the national measures. The use of the metre and the metrical weight has been adopted by the civil and military engineers, by the departments of artillery, bridges, and roads, and by the officers of customs and taxes.

A. 22. Professor MILLER.

Apparently the best definition of a standard of measure is the distance between two marks on a bar at a given temperature; or, in case the bar should be lost, a certain fraction, very nearly equal to 1, of the distance between two marks on some similar bar which has been compared with the former. (It is here assumed to be impossible to make the distance between two marks on one bar exactly equal to the distance between two marks on another bar.)

In order to meet the very improbable event of losing the whole series of such bars, it is desirable that the distance between the marks should be compared with some distance existing in nature, such as the length of the seconds' pendulum, a portion of an arc of the meridian, (or the value of λ for some deficient ray in the solar spectrum); of these the length of the seconds' pendulum is probably much the best. But, whichever we adopt, the circumstances of the observation should be very accurately recorded, and no reductions applied except such as are independent of physical arguments. For example, the standard of measure might be expressed in terms of the distance between the knife-edges of a Kater's pendulum of given form and density, swinging seconds in air at a given temperature, pressure, &c., on a given spot not in terms of an imaginary pendulum, in absolute vacuo, at the level of the sea, &c., circumstances in which the observations cannot be made, and to which the observations cannot be reduced, on account of our imperfect knowledge of "the constants of nature," on which the reductions depend.

A. 23. Professor MILLER.

The best definition of a standard of weight appears to be, the weight of a certain lump of metal diminished by the weight of the air it displaces at a certain temperature, pressure, and dew-point.

A. 24. Mr. PARKER.

Proposes that the gallon shall contain $256 = 8 \times 8 \times 4$ cubic inches.

A. 25. Colonel PASLEY.

Proposes to define the foot by $\frac{1}{360000}$ part of a degree.

A. 26. Colonel PASLEY.

Proposes a new pound which shall weigh $\frac{1}{35}$ part of the weight of a [new] cubic foot of water at 18° centesimal.

A. 27. *Prussian Law Instructions.*

§ 1. The fundamental measure for all the Prussian States is the Prussian foot.

§ 2. Under this name shall be understood the Rhinland work-foot, so called in Prussia, and introduced into the Mark and Pomerania since the 28th October, 1773.

§ 3. It contains 139·13 lines of the Paris foot generally known in scientific works.

But that the magnitude of the Prussian foot-standard, upon which the other measures and weights are based, may be established, without dependence on other standards, upon a natural measure which may at any time be recovered in case of doubt; on the termination of the observations for the length of the seconds' pendulum at Berlin, this length and its proportion to the Prussian foot shall be published.

A. 28. *Prussian Law Instructions.*

§ 11. The Berlin scheffel shall contain 3,072 Prussian cubic inches. (This is the foundation of the Prussian measures of capacity.)

§ 18. The weight of a Prussian cubic foot of distilled water in vacuum, at a temperature of 15° of Reaumur's mercurial thermometer, is to be divided into 66 equal parts. One such part is a Prussian pound. (This is the foundation of the Prussian weights.)

A. 29. *Russian Papers.*

La nécessité de fixer d'une manière invariable tant les poids que les mesures linéaires et de capacité de l'Empire, ayant porté le Gouvernement Impérial à instituer à cet effet en 1833, une commission composée de savans et d'experts, et cette commission ayant terminé ses travaux en 1835, Sa Majesté l'Empereur daigna confirmer par un Oukase du 11^{me} Octobre de la même année les principes adoptés par elle, et il fût en conséquence décidé ce qui suit :—

1. Le poids Russe aura pour unité la livre normale fixée par la commission, et basée sur les resultats obtenus, qu'un ponce cubique (Russe ou Anglais) d'eau pèse, dans le vide, et par une température de 13 $\frac{1}{3}$ ° de Reaumur, 368,361 dolys ; ou bien qu'une livre Russe de cette même eau équivaut à 25,019 ponces cubiques Anglaises. Ce poids correspond également à la livre dorée déposée à l'Hotel des Monnaies à St. Petersburg et reconnue depuis 1747 pour base du système monétaire en Russie.

4. La mesure de capacité restera :—

a. Pour les liquides, le vedro, équivalent à 30 livres d'eau distillée par une température de 13 $\frac{1}{3}$ ° Reaumur, ou à 750·57 ponces cubiques, et subdivisé en demi-vedro, en krouschka ou du $\frac{1}{10}$ vedro, et en demi-krouschka.

b. Pour les céréales, le schetwerik, équivalent à 64 livres d'eau distillée par la même température, ou à 1601·22 ponces cubiques, et subdivisé en demi-tschetwerik, en tschetwerka de 16, et en garnetz de 8 livres.

A. 30. M. SCHUMACHER.

I have, for the Hamburgh Senate, arranged their weights and measures, which were in great disorder. For the weight, I have copied the brass weight which the Bank used, in solid platina, and this platina copy is invested with legal authority. Of the new standard a copy, as like as possible (the difference is accurately ascertained), is made also of solid platina ; and to preserve the system, it is ordered that as soon as one of these two weights (kept at different places) should be lost, a new weight is to be made, which, if the standard is lost, will be a new standard determined after the known difference of the proposed copy from the lost standard ; if the copy is lost, will be a new copy whose difference from the standard weight is to be ascertained. Standard and copy are compared, each ten years, 50 times, and their difference is the mean out of all comparisons made from beginning. The copy is compared every fifth year with the brass pound of the different authorities, after which the weights for commerce are adjusted. It seems nearly impossible that this weight should be lost—copy and standard must be lost at the same time. When this should happen, then, and only then, a known volume of pure water is taken in to restore the weight.

The length measure is similarly arranged, and the last reference is the length of the pendulum which I found at Gùldenstein. Our Danish system of weights and measures is arranged on the same foot. The Danish foot is exactly the same as the Prussian, and as last resource attached to the Gùldenstein pendulum.

A. 31. Mr. THOMSON.

That the gallon contains 10 lbs. of water is highly convenient, as the specific gravity of any liquid represents in pounds and decimals the weight of a gallon of it. I do not see what would be gained by making 1000 ounces exactly equal to a cubic foot. Ounces and cubic feet are

A. 31. Mr. THOMSON—*continued*.

not the units generally in use—in our business at least; the units are pounds and gallons. In the chemistry of colour-making, it is desirable that the measures of water and other fluids employed should be in simple proportion to the units of weights of solids employed, because, atomically considered, weight and not measure represents the combining equivalent. I should by all means, however, recommend the retention of the present definition of an imperial gallon. And if it could be universally adopted, to the exclusion of all other and different measures of capacity, it would be a useful simplification.

A. 32. TURIN ACADEMY.

Recommends the standard of 1''' of terrestrial meridian, as deduced from the French arc; but also states the length of the seconds' pendulum.

Recommends that the weight of a cube of $\frac{1}{3}$ of a foot of distilled water should be 164 ounces.

Recommends that the measures of capacity for fluids and dry substances should be determined by weight.

A. 33. *Westminster Review*.

English linear measures have been defined by recording that a pendulum making a swing every second at London contains 39·1393 English inches; Danish linear measures by recording that a pendulum making a swing every second, at the latitude of 45°, measures 38 Danish inches. Definitions like the Danish or English are indeed more properly definitions of certain pendulums by given linear measures, than definitions of certain measures by given pendulums. Considered as harmless records, such definitions may be admitted as likely to be useful, perhaps, once in a thousand years, on the necessity arising for restoring the standards; yet, for the more ordinary purpose of verification, it must be confessed that neither the one nor the other is of much practical value. But there is another and much more direct way of defining linear measures by the pendulum. We may at once assume a pendulum precisely equal in length to that standard itself; and we may define it by recording the number of swings it makes in a given time, not merely in one latitude, but in as many latitudes as are ever likely to be useful for the purpose of practical verification.

A. 34. *Westminster Review*.

Recommends a new ounce (with the proposed name Crown ounce), differing from the Troy ounce in the proportion of 10 : 11, and from the Avoirdupois ounce in the proportion of 384 : 385; which would exactly represent the weight of $\frac{1}{1000}$ cubic foot of water, at the temperature 59° Fahrenheit, or 15° centigrade.

A. 35. *Westminster Review*.

Recommends a gallon of 270 cubic inches, which would make the quarter equal to 10 cubical feet.

A. 14*. *L'Institut*.

In No. 373 of this periodical, there is an abstract of a memoir communicated by M. Kupffer to the Royal Academy of Sciences at Petersburg, on the weight of an English cubic inch of pure water at the temperature 13 $\frac{1}{3}$ ° of Reaumur, and in vacuum, as determined by different experimenters. After all reductions for the different measures and different weights used, the following results are obtained, expressed in Russian *doli*, of which 9216 make a Russian pound :—

M. Lefèvre Gineau . . .	368·365
The English Commission . .	368·542
The Swedish Commission . .	368·474
M. Stampfer	368·237
The Russian Commission . .	368·361

SECTION B.

EXTRACTS RELATING TO THE CONSTRUCTION OF PRIMARY STANDARDS.

B. 1. *Base du Système Métrique.*

Vol. III., p. 446. Les étalons en platine et en fer, de l'Institut, ne portent aucune division, la longueur du mètre étant donnée par la distance entre leurs extrémités.

B. 2. *Base du Système Métrique.*

Vol. III., p. 680. The form of the toise of Peru (which is also figured in other works) is the following, the measure being to the end of the shorter part of the bar.

B. 3. *BESSEL'S Standard.*

The unit of the English measure is the distance between two points or lines engraved on the surface of a bar. Supposing that the measure is thus clearly defined, the following points are still necessary: that the bar remain in its original state, that the points or lines be neither rubbed out nor otherwise injured; and that, if lines are used, they either be parallel, or be used only at definite parts.

With regard to the effects of flexure. The thickness of a bar must not be too much increased, lest the danger of unequal temperature be incurred. Now, supposing a flexure, its effect on the measure of the distance of the ends, in the axis of the bar, is insignificantly small, but its effect on a measure of the distance of the points marked on the surface is very sensible. Kater's suggestion of cutting away half the thickness of the bar at its ends, and engraving the defining points on the surface corresponding to the axis of the bar, deserves commendation. It is especially advantageous in providing against the effects of accidental permanent bending of the bar, which would produce a large error in a measure marked on the surface of a bar.

B. 4. *BESSEL'S Standard.*

I have no belief in the security of a measure defined by very fine points or lines, as compared with that of a measure defined by end-surfaces of sapphire, such as I have adopted. I believe that, both for the convenience of comparison which is allowed by the hardness of the material, and for the absolute durability of the measure, the latter is greatly preferable.

Either method may be used to define unequivocally the length of the standard.

The definition by ends of a bar is particularly adapted to easy and accurate comparison of copies, by means of a fühl-hebel carrying a spirit-level. I must not omit to say, that measures of ends are exactly those which are adapted to the most delicate purposes; at least I have proved this to be my opinion, by using such measures in my pendulum-experiments.

Mr. Baily's remark, that the lines of a scale, as viewed by different observers, are not seen in the same place, gives another reason for preferring the method of end-measures.

B. 5. *BESSEL's Standard.*

The Prussian standard of 1816, and its three copies, are iron bars, a little more than 3 (Prussian) feet in length, 14·6 lines broad, and 4·9 lines thick. The length of 3 feet (as well as the subdivision into 36 inches, and of the last inch into 12 lines), is marked by fine lines or strokes. Two longitudinal lines, 0·4 lines apart, define the parts of the strokes which are to be used for measure. The law has not defined the temperature; but it is presumed that, as the law stated its length at 139·13 lines of the toise of Peru, it intended that the same temperature should be adopted, namely, 16·25° centigrade.

The length, however, is doubtful to a small extent, because no direction is given as to the way in which the standard shall be supported, which, as Kater has since shown, produces an uncertainty of sensible amount.

6. *BESSEL's Standard.*

The new Prussian standard is a bar of cast-steel, nearly 3 feet long, and 9 lines square. Truncated cones of sapphire, with the smaller ends outwards, are let into the ends of the bar. (The way of inserting the sapphire is particularly described). The sections of the sapphire ends in two directions, have been ascertained by measures with a micrometrical apparatus.

Having been compared with three good copies of the toise (by a method fully described), and having been found equal to 417·38939 French lines, whereas the standard is defined by law to be 417·39 lines, which is greater by ·00061 French lines, or ·00063 Prussian lines, the bar bears the following inscription:—

“Standard of the Prussian unit of length, 1837. This bar, in the temperature 16·25° of the centesimal thermometer, measured along its axis, is 0·00063 lines shorter than 3 feet.”

By the law of 10 March, 1839, this bar is declared, with the correction above mentioned, to be the legal standard.

B. 7. *BESSEL's Standard.*

All the comparisons are made in spirits of wine.

B. 8. *BESSEL's Standard.*

The thermometrical expansion of the new standard was carefully ascertained by independent experiments; and a table of expansions is formed, which is used for correcting the length in comparisons with copies at other temperatures.

B. 9. *Mr. BLACKBURN.*

All standards and weights should alone be made of hard metal, such as the standard measures are generally made out of (not of the soft yellow brass so commonly used for standard weights); by experience I know they will retain their accuracy half as long again.

B. 10. *Connaissance des Temps, 1837.*

From the method used to compare the Vienna half-toise or halb-klafter, it is evident that the standard of the halb-klafter, used in this comparison, is a measure by ends.

B. 11. *Mr. DE GRAVE.*

A mixture of tin and copper, or in other words gun metal, I consider the best metal for all standards, being much harder than what is termed yellow brass, which is a mixture of zinc and copper.

B. 12. *Mr. HASSLER.*

The first operation necessary for the use of any comparison, is the comparison of the scale

B. 12. Mr. HASSLER—*continued.*

within itself, upon any distance that is to be compared; for the mean of all such distances measured upon this scale is the proper measure to be taken according to the principle of all English divided scales.

B. 13. Mr. HASSLER.

The temperature of 32° Fahrenheit, or the melting ice, is a fixed point of the thermometric scale, generally ascertained by actual experiment, thence more to be relied on than others, which are determined by different proportions. It is adopted for the French length measures. The necessity to account for the expansion of the metal of the scale, and to reduce the results to a certain temperature, makes it desirable to select for this a point as well fixed as possible, and which in practice may be easily maintained, particularly when the standards to be compared are of different metals. This last consideration, I suppose, has in England occasioned the adoption of 62° Fahrenheit as standard temperature, but I found it in this country very unsteady, and not maintainable, while the temperature of 32° Fahrenheit can be much better maintained, and even the influence of the proximity of the observer is less.

B. 14. Mr. HASSLER.

The introduction of platinum instead of brass might be thought of, on account of its less destructible nature; but the expansion of it is by no means so well known as that of brass.

B. 15. Mr. HASSLER.

The expansion of iron, though greater than that of platinum, is much better known, and the refining of platinum is yet made so unequally, that an iron metre or standard of any kind is preferable to one of platinum.

B. 16. Mr. HASSLER.

It will be observed that the copies of the mètre are shorter than the original mètre of the committee. This I have found to be uniformly the case in copies of standards cut to a length.

B. 17. Mr. HASSLER.

It is proper to make choice, for practical use, of such an arrangement as will give the required accuracy equally as well as the scale, by more mechanical means, and which at the same time will shelter itself from deterioration, or detect it if occurred. To this purpose the French manner, in which the standards of toises were frequently made, is, in all respects, best adapted. The standard consists in a measure cut to length, and its matrix, with sufficient strength of back to each of them, thus:—



The standard length unit being $a b$, the lower part will furnish this length cut off, or what is called in French, "à bouts," projecting from its back about $\frac{3}{4}$ of an inch or more. The upper part presents a long notch, exactly fitting over it; it is proper not to let this come up entirely in the corner of the standard's cut, that some space may be left at the two ends for the insertion of some wedging tool to separate them gradually. The thickness of the bars must never be less than half an inch, and the breadth of the two together, should be rather more than three inches. It is evident that the line of contact of the two measures is well observable by a microscope, in the same manner as a divided scale; and that therefore, for the unit length, the arrangement serves equally like a scale: to trace or adjust measures from it,

B. 17. Mr. HASSLER—*continued.*

without the aid of microscopic arrangements, it is evident that either a measure cut to length can be fitted into the matrix, or a matrix to be used for other standarding can be fitted over the length measure, with equal ease. It is possible to make this fitting by the touch to a very great accuracy, when the metals are of the same kind and of equal temperature; and with precautions, as all such works require, I have, by my own experience, found the same accuracy attainable as by any other method; it is necessary in all this that the parts joining must be worked to a very nice perpendicular, and to full contact over their whole length and breadth.

B. 18. Mr. HASSLER.

For standard weights, a certain proportion of copper and tin, or zinc, appears to be the best in the absence of perfect brass (that is, copper exactly saturated, by cementation, with pure zinc: neither over nor under saturated). For this, to my knowledge, we would have to resort to Calcutta or China: the European, and especially the English art, appears in this point to be behind the old eastern art. One caution is to be given against the old bad habit of making a mass finished off and polished, with a hole in it, in which small pieces of another metal are enclosed, to satisfy the equilibrium: this occasions, by the galvanic action between the two metals, an oxydation that changes the weights by the process of time more than their wear in use would do; therefore weights, to be accurate, must be made of one mass and metal, and ultimately rubbed down to the full adjustment; if by that they become too light, they must simply be rejected.

Brass is only to be chosen on account of its cheapness, and the almost general habit of its use for that purpose, by which, therefore, other weights are made equal to the standards without the influence of their different buoyancy in the atmosphere, as would be the case if the standards were made of platinum, which would evidently be the best metal now known, for this purpose, if sufficiently common.

B. 19. Mr. HASSLER.

It appeared also preferable to determine a certain stand of the barometer, rather than to reduce to the vacuum.

B. 20. Mr. HASSLER.

There are considerable difficulties in obtaining scale beams uniting great accuracy for large weights with the necessary strength to support them. For these reasons—[Mr. Hassler then describes a sort of hydrometer balance applicable to the method of double weight.]

B. 21. Mr. HASSLER.

The temperature of 62° Fahrenheit, is, however, rather unfavourably chosen, in general principles, because the water at that temperature (which it is always difficult to keep the same) is under considerably variable influence, expanding differently for each degree of temperature above or below it, and varying its density according to the depth of the vessel, and the difference between the temperature of the water and that of the surrounding air.

B. 22. Mr. HASSLER.

Distilled water furnishes the very favourable property of having a point (as it may be called) of maximum density, which is at the temperature of 39·83° of Fahrenheit's thermometer. This temperature, or rather the indication of the maximum density, is therefore very properly chosen to determine the bushel and gallon, by the weight of distilled water which their legal capacity will contain. In the operations for the French system of weights and measures, this temperature of the maximum density has been adopted for the standard units of weights and of capacity measure.

B. 23. Mr. HASSLER.

The standarding of the capacity measures being determined by the weight of distilled water which they contain, it is proper to give to the standards, from which all others are to be made, that form which will give the greatest accuracy in their filling; therefore, the smallest top surface that is well admissible with an otherwise convenient shape. This does not hinder that the measures for common use, that will be standardised from them, have the form most convenient for practical use; for instance, in the liquid measures, cylinders having the altitude and the diameter of the base equal: and in dry measures, that are often used heaped, the diameter of the base double the height.

It will be best to choose the metal of which these standards are to be made, the same as that of the weights and of the length measures. The determination of the expansion of this metal by temperature will be one of the necessary experiments to be made with the length measures, and it will therefore then apply equally to the whole system.

B. 24. Mr. HASSLER.

In England, no regard was paid to the form of the measure, or to the materials of which it is made; two points which are not without notable influence, when it is the question of accurate standards.

B. 25. Mr. HASSLER.

According to Van der Toorn, the temperature at which, by the expansion of the water, and that of the litre, constructed of different materials, the litre contains again an equal weight of water as at the maximum density, is as follows:—

For a glass vessel.	45.2 Fahrenheit.
„ brass ditto	52.8 „
„ copper ditto	51.8 „
„ pewter ditto (5 tin, 1 lead) . . .	56.3 „

B. 26. Capt. KATER.

A national standard should be accurately that which it professes to be. It is not enough to determine its error, as the record of this may in process of time be lost; it therefore became necessary to devise a method by which any perceptible error in those standards, which are the foundation of all the others, might ultimately be annihilated.

B. 27. Capt. KATER.

Recommends a mixture of 576 parts copper, 59 tin, and 48 brass, for standards, (it is not clear whether for linear measure or measures of capacity).

B. 28. Professor MILLER.

It is said that the (nearly equal) lengths of two bars terminated by parallel planes can be compared by means of a “fühl-hebel,” much more accurately than any two distances can be compared optically.

But bars, the lengths of which are not nearly equal, must be compared optically, and the distances to be compared are much more frequently unequal than equal, hence lines mark the terminations of the standard of measure more conveniently than planes. The great difficulty of giving the ends the form of nearly parallel planes, is also a serious objection to a measure “à bouts.” The best mode of using a measure “à bouts” appears to be in a vertical position, as in Bessel’s pendulum observations, for the parallelism of the ends is not disturbed by bending.

The material, form, and manner of supporting the standard, are of very great importance, and must be considered at the same time, for they depend upon each other.

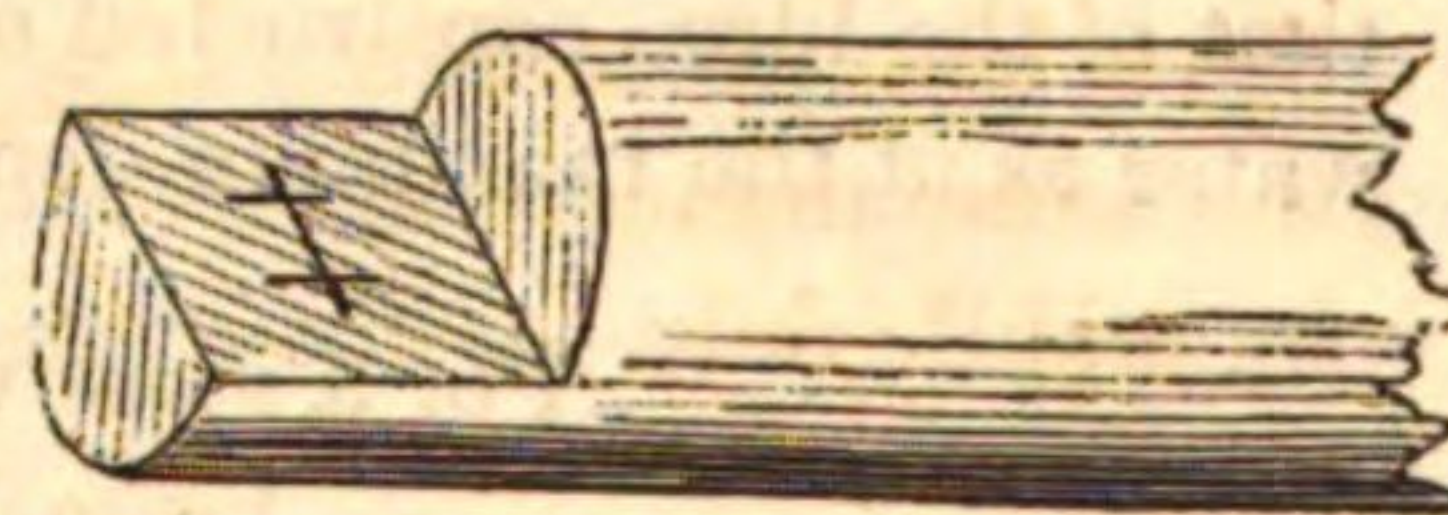
B. 28. Professor MILLER—*continued*.

Platinum, on account of its lead-like texture, seems not to be very fit for the purpose. It will not rust certainly; but it must be guarded from mechanical injury, and very little more care would protect any other metal likely to be employed from growing rusty. It is also very infusible, yet I question if any body would be inclined to trust a platinum metre that had been dug out of the ruins of the houses of Parliament, after they had been burnt down.

Of metals of this kind, palladium would probably be the most suitable—in the quality of inflexibility it more nearly resembles iron; its specific gravity is only about 11·5, little more than half that of platinum; it has nearly the same expansion, and costs about the same by weight, is indestructible by damp, resists the action of acids tolerably well, and is more infusible than gold.

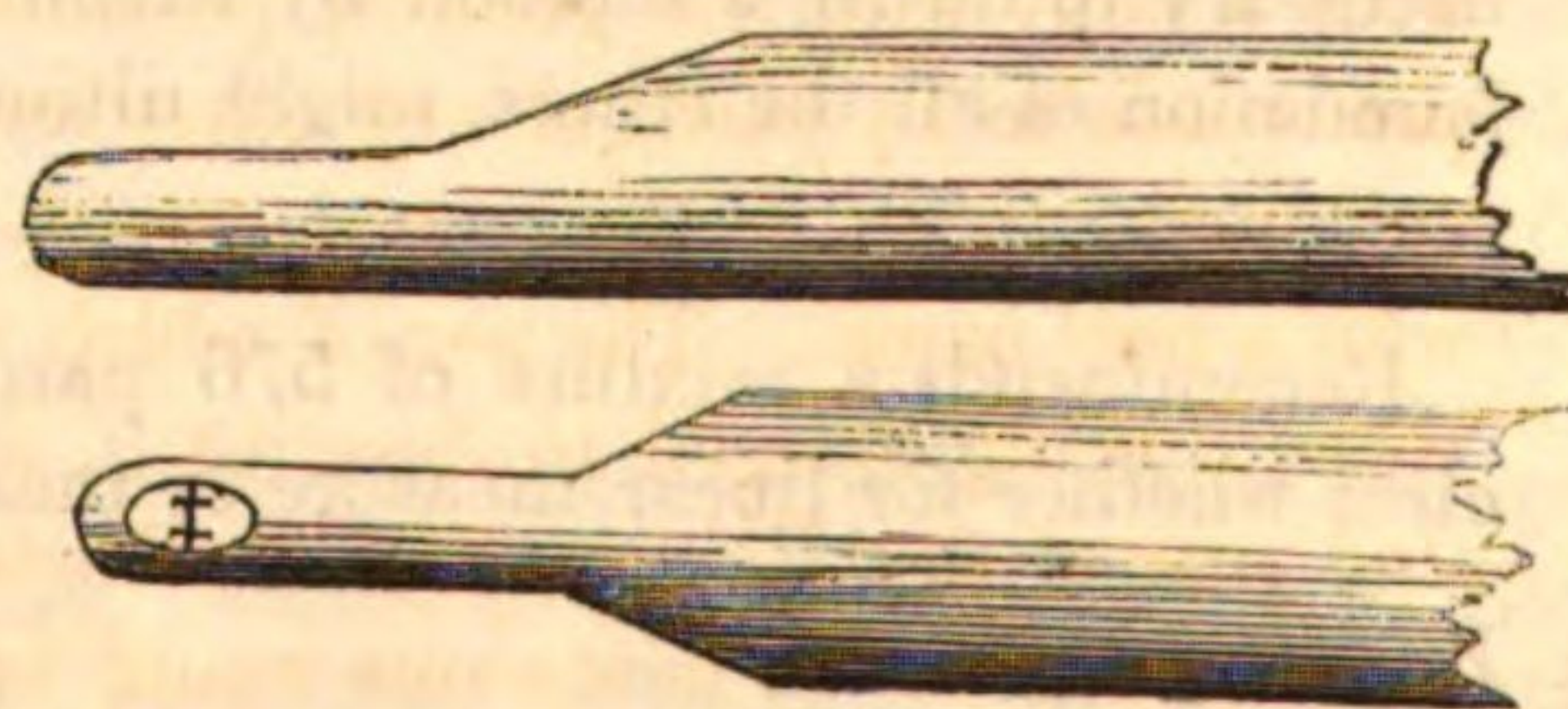
Standards of either platinum or palladium must of necessity be too slender to stand alone, and the observations of Mr. Baily shew that a standard of one metal placed upon another, is not to be trusted. Bell-metal, or even speculum-metal, if it could be cast without cracking, would seem to be a better material than brass, on account of being more elastic, and than iron or steel, on account of being less likely to rust. It is true they could not easily be made into a tube, which Mr. Baily recommends as the best form, and it may be the best for a standard *scale*, but I doubt whether it is so for a standard *measure*, on account of the distance of the line carrying the divisions from the axis. I think the tube-scale or measure, as well as a bar-scale, would be improved by making the surface on which the division is engraved, vertical, and consequently the axis of the reading microscopes, horizontal.

A tube measure might have a semicylinder taken away from each end, and the lines traced upon plates, the surfaces of which coincide with a diametrical plane of the tube, as represented in the annexed figure.



For tube measures, and perhaps also for bar measures supported at two points, I think no material will be found equal to glass free from lead. It is very light (specific gravity 2·5), expands not more than platinum, and the lines on it might be viewed as transparent objects, and consequently microscopes of very high power employed. Errors, which at present may arise from a side illumination, would be completely avoided.

Any violence that would break a glass tube, would certainly spoil a metal standard; and, by breaking, a glass tube would shew that it had been exposed to such violence, which a metal bar or tube would not do. A glass tube might be easily drawn out at the ends, so that flat surfaces might be formed for receiving the lines, the planes of which coincide with a diametrical plane of the tube.



A slip of plate glass from $\frac{1}{2}$ an inch to 1 inch thick, and 4 or 5 inches wide, placed with its broad face vertical, would, I think, make a very excellent bar measure.

If it were not convenient to have the lines traced upon a vertical plane, the ends might be partially cut away, so as to bring the plane of the divisions into that position which would render the distance between the divisions least dependent upon the place of the supports.



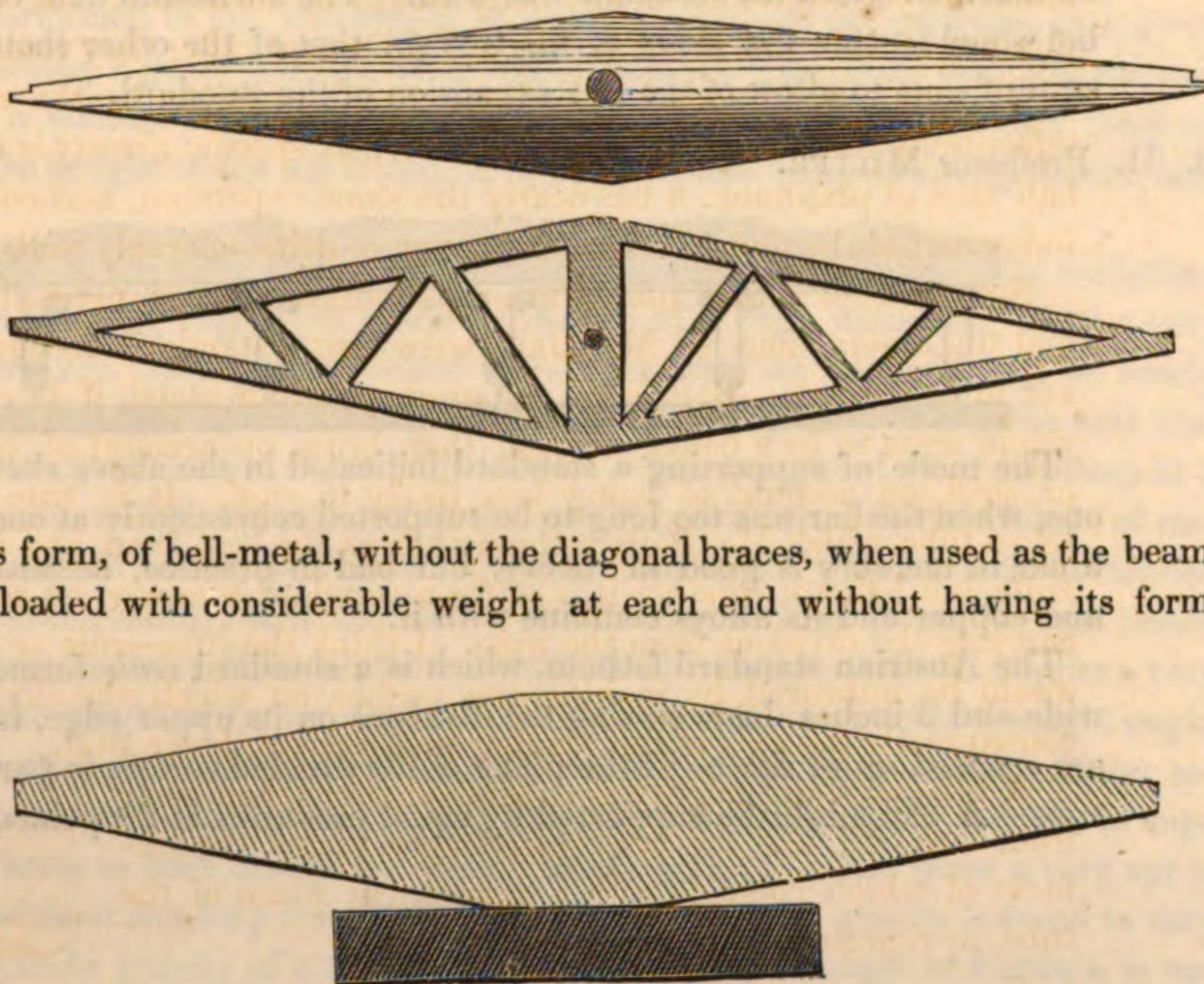
Steinheil goes so far as to recommend glass as the best material for a meridian circle. The difficulty of fastening it to its axis so as to turn with the telescope, is an objection to its use for a circle which does not apply to the employment of glass for a standard measure.

B. 28. Professor MILLER—*continued.*

The difficulty experienced by Mr. Baily in finding two proper supports for his tubes, seems to shew that the use of two supports should be avoided if possible. This might be done by making the standard a double hollow cone of metal, supported upon trunnions at the common base of the cones; or, if it be thought that the middle part would be in the way of the bar that carries the microscopes, the standard might be a rhombic frame like the beam of one of Robinson's balances with diagonal braces.

A pierced rhomb of this form, of bell-metal, without the diagonal braces, when used as the beam of a balance, may be loaded with considerable weight at each end without having its form altered.

A rhomb of plate glass might, I conceive, be supported in the same manner, at its middle only.



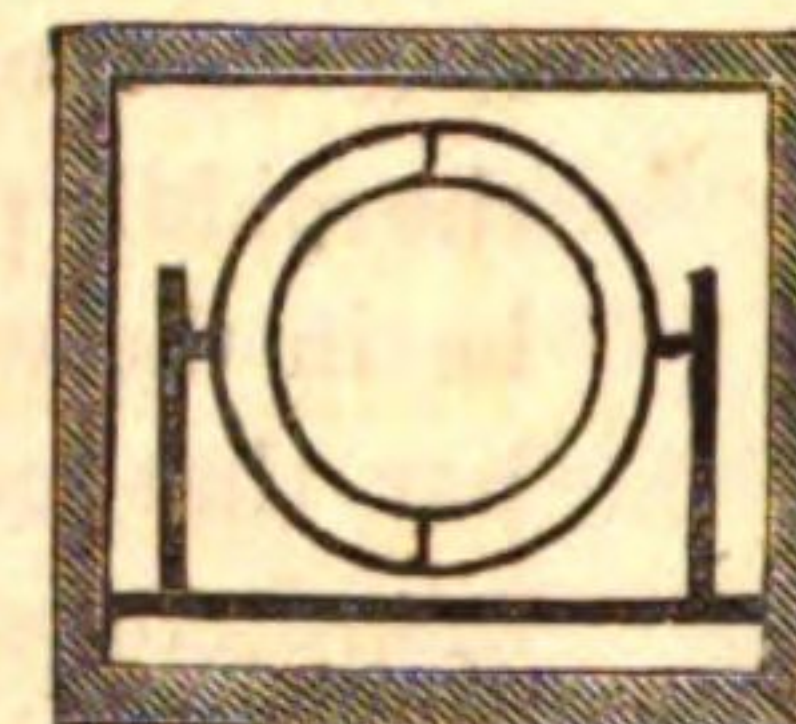
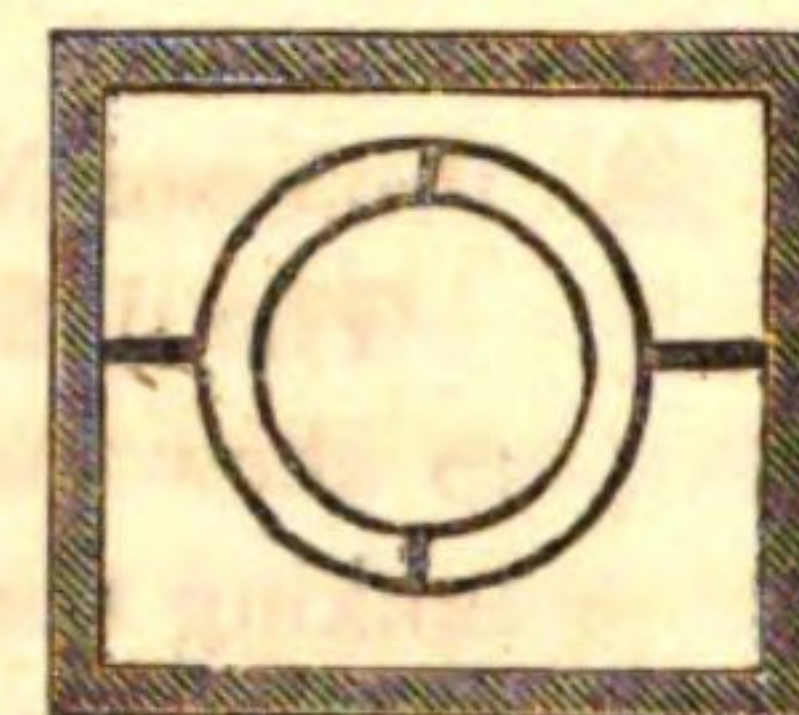
B. 29. Professor MILLER.

The consideration of the length of the standard is intimately connected with that of its form. If made too long, especially if supported at the middle, or at two points only, it would bend too much with its own weight, and the transport of copies of it would be attended with difficulty. I consider it more important that its length should be such as to allow it to be compared with a copy with the greatest possible accuracy, than that it should be 1 or 2 yards long in preference to $1\frac{1}{2}$ yard, or any other length bearing a simple ratio to the yard. As it is already customary to divide the inch decimally, might not 10 or 100 inches be created into a standard with a new name. The use of which would obviate all doubt about the nature of the measure, without being obliged to describe it, as "the measure established by Act of Parliament in the 2nd year of the Reign of Queen Victoria." The metre owes much of its value to its unambiguous name. A new name would be serviceable, even without a decimal division.

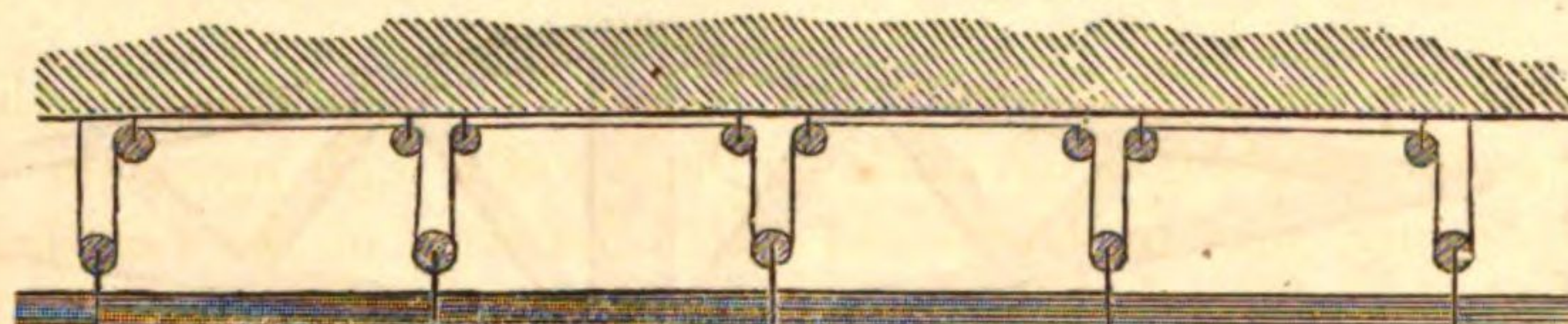
To return to the question of the length of the standard, the limits of its length would probably be between 3 and 6 feet. Below 3 feet the error of comparison would be spread over too small a space; above 6 feet, the standard would cease to be sufficiently portable, at any rate it should not be more than 100 inches; the length in inches might be one of the following numbers, 36, 40, 50, 60, 72, 80, 100; 36 inches has apparently nothing to recommend it beyond the importance which for 10 years it enjoyed by Act of Parliament; 40 inches would be convenient in comparisons with the metre and seconds' pendulum; 50 or 100 inches accommodate themselves to a decimal division. So would 60, the unit being a foot: it is also the length of the Astronomical Society's scale. The fathom 72, and 80, might be compared readily (the latter especially) with the double metre, the double pendulum, the toise of Peru, and the Vienna klafter.

B. 30. Professor MILLER.

When the standard is a tube or bar supported at two points, I think it would be a good plan to have gimbols at the points of support in a trough, in which it should be always kept. A lid at each end of the trough might be taken off when the standard was used. The horizontal axle of one gimbol should enter the sides of the trough, that of the other should be in a swing frame to allow of the free expansion of the standard.

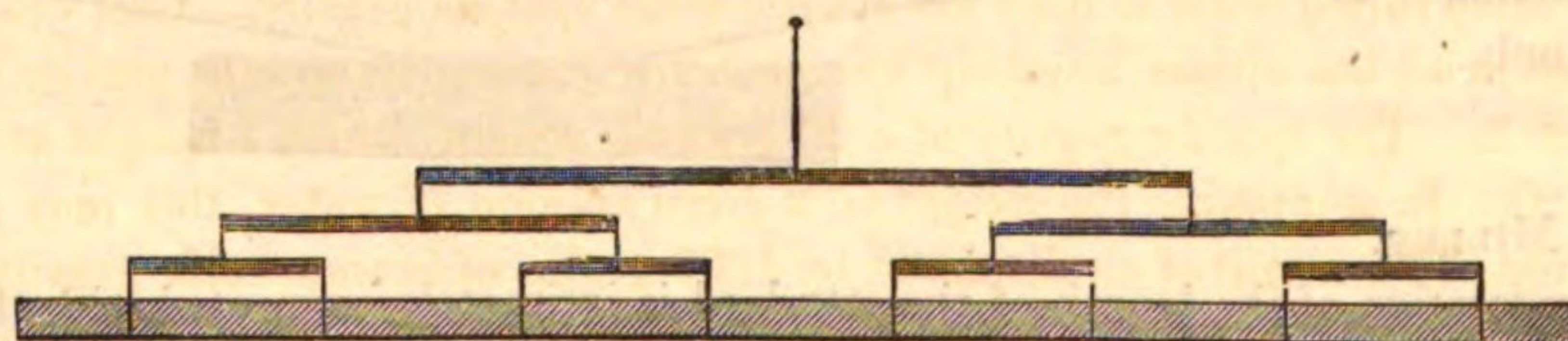


B. 31. Professor MILLER.



The mode of supporting a standard indicated in the above sketch, would, I think, be a good one, when the bar was too long to be supported conveniently at one or two points only. Floating a bar in mercury is good in theory, but bad in practice, because iron rusts easily in mercury, and copper and its alloys combine with it.

The Austrian standard fathom, which is a standard *scale* formed of a bar of iron about $\frac{1}{2}$ inch wide and 3 inches deep, having the divisions on its upper edge, is supported by 6 screws, which are screwed up or down till the plane of the divided surface is parallel to a fine tightly-stretched wire. A bar might be supported by equal pressures at 2ⁿ points, by a system of levers thus:—



The counterpoises act through the intervention of a similar combination of levers, in some of the "vollkommenbalancirt" Munich instruments.

B. 32. Professor MILLER.

I see no reason why the measure should be exactly true at the "standard temperature" as long as the error comes within the range of the micrometer employed; indeed, "standard temperature" leads to much confusion, and ought to be put aside as a most pernicious fiction.

Stampfer's plan of throwing the difference of the scales entirely upon the temperature is, I think, most excellent. It would be very difficult to misunderstand such a statement, as "at the temperature centigrade, the distance between the lines marked and is equal to inches," engraved upon the bar, together with its expansion between freezing and boiling water.

All temperatures should be expressed in degrees centigrade, because the boiling point of Fahrenheit's scale is not defined. A committee of the Royal Society recommended that it should be the temperature of boiling water, when the barometer stands at 29.5 in.; most writers, however, assume it to be the temperature of steam when the barometer is at 30. And all parties have apparently agreed to disregard the uncertainty in the height of the mercury in the barometer of 0.13 in. due to change of temperature, 0.1 inch or more due to capillary depression, and 0.07 in. due to the variation of the force of gravity in different latitudes. When these sources of error fall together they produce an uncertainty of 0.8 in. in the barometer, and an uncertainty of 0.8° centigrade in the boiling point, and therefore an error of 0.13° at 16° centigrade.

B. 32. Professor MILLER—*continued*.

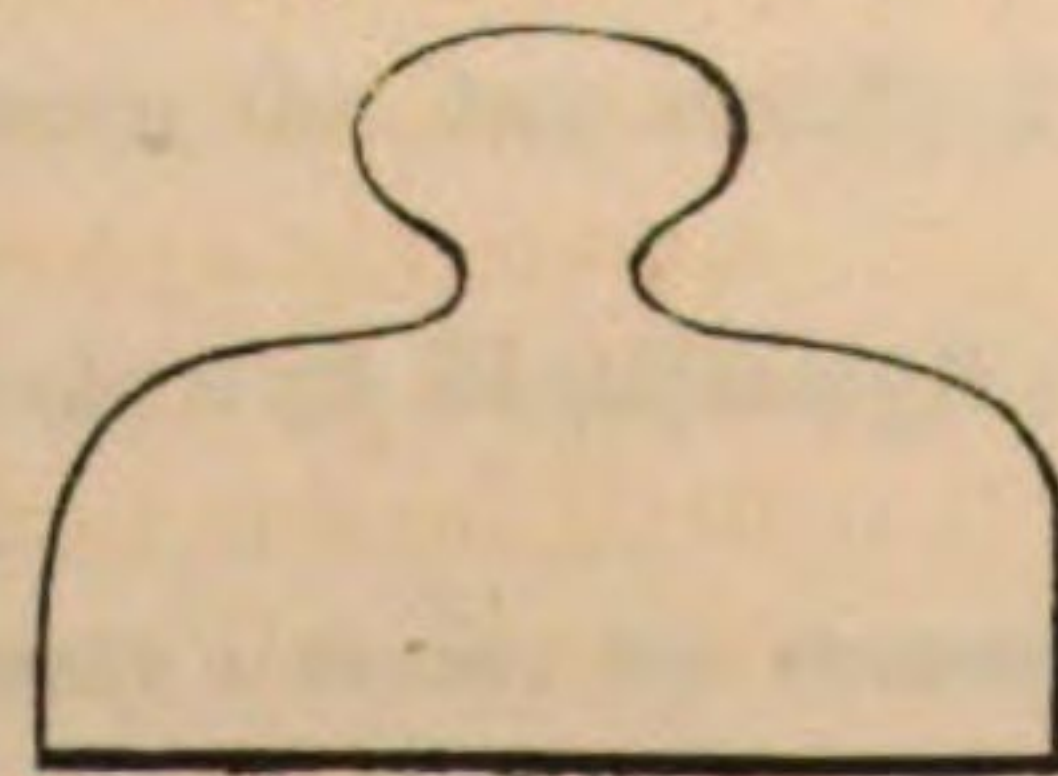
This will correspond to only 0·00005 inch in a 36-inch brass scale, but would produce considerable error in the determination of a cubic inch of water.

B. 33. Professor MILLER.

Weighing must be performed in air, the weight of which, under a given pressure, at a given temperature, and containing a given quantity of moisture, has not been at all well ascertained. The best definition of a standard of weight appears to be the weight of a certain lump of metal, diminished by the weight of the air it displaces, at a certain temperature, pressure, and dew point.

For though the weight of the air it displaces may be considered as unknown, the variations of its weight, so long as the weighing is not made on the top of a high mountain, or at a very high or very low temperature, may be determined within the error of the weighing, or nearly so. Of any copy of this lump of metal having a different specific gravity it may be said that the standard of weight is equal to the weight of this lump — $m \times$ (weight of air it displaces at a given temperature, pressure, and dew point); when the specific gravities of the two lumps of metal are nearly the same, m will be very nearly unity, and the correction, which will be multiplied by $(1 - m)$, will be a small quantity, and therefore a small error will not affect the final result. When the specific gravities are very different, the correction will be large, and will require a very accurate knowledge of the weight of the air displaced; for this reason the standard weight ought not to be of platinum, unless the copies of it are mostly made of the same metal. Kater assumed the weighings to be made in air of given specific gravity, but fell into the mistake of supposing the alloy called brass to have always the same specific gravity. Cast brass is very apt to have cavities in it; but without any help from defective casting, its specific gravity is found to vary from 8 to 8·5. The specific gravity of a 20-gramme weight, which I bought at Fortin's, is upwards of 8·6. In computing the weight of a given volume of water, this may produce a very sensible error. The weight of air displaced by 1000 grains of brass specific gravity 8 — weight of air displaced by 1000 grains of brass specific gravity 8·5 = 0·01 grain. But one of Robinson's balances, with 1000 grains in each pan, turns readily with 0·001 grain. The French, who reduce their weighing to vacuum, have two platinum standards of equal authority; at ordinary atmospheric pressure their weights appear to be equal, but they have different specific gravities, and therefore when reduced to vacuum must be unequal. From some inattention to the specific gravity of the brass, and the pressure and temperature of air at the time of comparison, arises, I presume, the enormous discrepancy between the standard weights (duly accompanied by stamped certificates), which have been observed by Moll, Schumacher, and others. Kater, who was bent upon making every thing exact at the "standard temperature and pressure" (otherwise he would not have used points for the marks on his copies of the standard of measure), had a cavity in his weights for containing bits of wire to make the weights "exact." This cavity would be apt to collect moisture, and get corroded, and alter the weight of air displaced by the whole weight. One could not venture to weigh the standard in water, in order to find its specific gravity, when it contained a cavity closed only by screws.

Kater's form of weight is the most convenient of any.—It is the solid generated by the revolution of a curve like that represented in the diagram; a wooden fork, a little wider than the neck of the knob, serves to lift it in and out of the scale. My Fortin's 20-gramme weight, a double cube, with its edges blunted, is extremely inconvenient. Weights made like the French weights, in one piece, are apt to be a little too large; a workman, in adjusting them, prefers leaving a small error in ex-



B. 33. Professor MILLER—*continued.*

cess, to the risk of incurring a larger error in defect which might spoil the weight. If once the "standard temperature and pressure" were got rid of, this difficulty would also disappear; a weight a little too large, will be right at a higher pressure or lower temperature, and a weight a little too small will be right at a lower pressure, or a higher temperature. The operation of determining the weight of a given volume of water is so laborious, that I question whether any person qualified for the task could be induced to undertake it; the solid should be weighed in water at that temperature at which the expansion of the solid for 1° is equal to that of the water; when the solid is of brass, this will be about 7° or 8° centigrade. The result obtained by Stampfer from 105 weighings in water of a brass cylinder 3 inches long and 3 inches diameter, is probably quite as good as any that could be obtained by repeating the operation here. Of course the English and Austrian standards of length and weight must be first compared.

B. 34. Mr. SCHUMACHER.—(Phil. Trans.)

It is to be hoped that no pound will in future ever be declared a legal standard, unless the specific gravity and expansion (the knowledge of which is indispensable, even for a single comparison with a good balance), are previously determined with the greatest possible precision.

SECTION C.

EXTRACTS RELATING TO THE MEANS OF RESTORING THE FORMER ENGLISH STANDARDS OF LENGTH AND WEIGHT.

C. 1. BAILY'S *Standard*.

Mr. Baily shews that there are abundant means of restoring the Parliamentary standard of length from the comparisons made with the Astronomical Society's standard, and with others of similar construction.

C. 2. Colonel COLBY.

Colonel Colby has in his custody two iron bars each 10 feet in length. Near their extremities the upper half of each bar is cut away, and the points by which the measure is defined are inserted in platina pins in the surface corresponding to the middle of the bar.

Colonel Colby has compared both of these bars with Troughton's scale, and Troughton's scale with Shuckburgh's scale.

The whole length of Shuckburgh's scale is 5 feet. Between the lines marking the tenths of inches there are points: there is also a point preceding the first line, and a point following the last line.

Colonel Colby's comparisons were made with the first and the last lines of Shuckburgh's scale, and also with the dots preceding and following them.

Captain Kater, in his former comparisons, used the dots only. He has not stated whether those preceding certain divisions or those following them.

The 10-foot iron bars have no intermediate points. The comparison with the 5-foot scale was made by placing three microscopes in a line, attached to stone piers, and by placing the ends of the 5-foot scale successively under the first and second and under the second and third, and then placing the 10-foot bar under the first and third.

In some comparisons, Shuckburgh's scale was placed on a table; in others it was floated on mercury. There was a small difference between the results.

Colonel Colby compared the successive feet of Shuckburgh's scale with each other by means of microscopes attached to stone piers. There were no means of allowing for the curvature of the scale, whether horizontal or vertical.

The comparative length of the whole scale has been ascertained, floating on mercury and on a straight edge, both with and without weights on the scale.

Colonel Colby compared the first 36 inches of Shuckburgh's scale with the lost standard yard. The lines and dots were used in these comparisons.

In comparing the middle yard of the Royal Astronomical Society's scale with Shuckburgh's scale, the lines marking 10 inches and 46 inches on the latter were used.

The 10-foot bar has been compared with the Royal Astronomical Society's scale, by means of microscopes fixed to piers.

C. 2. Colonel COLBY—*continued*.

The 10-feet bar was never immediately compared with the lost Parliamentary standard.

Colonel Colby has also two iron bars (marked 1 A. and 2 A.) of 3 feet each in length, with platina points. They are similar to the 10-feet bars in regard to the manner of cutting away the upper half of each end.

They were compared with the Parliamentary standard by Mr. Baily, Mr. Donkin, Mr. Donkin, jun., Lieutenant Johnson, and Lieutenant Murphy.

The number of comparisons is about 60.

C. 3. Mr. BINGLEY, jun.

Stated to one of the members of the Commission, that he knows the pound weight to which Mr. Schumacher has alluded, and that it is the property of his father, Mr. Bingley, sen.

C. 4. Mr. HASSLER.

The troy pound of the United States' Mint at Philadelphia was made by Captain Kater purposely for the Mint. The weight is in form similar to those made by Kater for the Exchequer, and inclosed within its box, in a brass form, upon which is engraved "Pound Troy, 1824, Bate, London." A detailed certificate of Captain Kater, dated London, 30th June, 1827, certifies to the comparison, and quotes the ultimate experiments with the same. A certificate of Mr. Gallatin, of the 24th July, 1827, testifies to its origin; and one of President Adams, under date of 13th October, 1827, to the safe and undisturbed reception thereof, so as to warrant full trust in its accuracy.

C. 5. Mr. HASSLER.

Extract from a paper procured at the Royal Mint, London, dated July 23rd, 1833, signed W. H. Barton:—"The pound directed to be used in future as the standard weight, by the Act of 5th George IV. cap. 74, being $1\frac{1}{2}$ grain heavier than the one previously in use," &c.

C. 6. Captain KATER.

Has copied four dot-standards from Sir G. Shuckburgh's scale. They are deposited at the Exchequer, Guildhall, Edinburgh, Dublin.

C. 7. Captain KATER.

Has copied four weights from the imperial troy pound. They are deposited at the Exchequer, Guildhall, Edinburgh, and Dublin.

C. 8. Professor MOLL.

Compared two attested copies of the Mint pound with a copy of the imperial troy pound made by Mr. Bate; found the former smaller than the latter by about $1\frac{1}{2}$ grain.

C. 9. Mr. SCHUMACHER. (Phil. Trans.)

Alludes to the circumstance that two copies of the troy pound were made at the same time as the late imperial standard; that one is in the possession of Mr. Bingley, and the other in the possession of the weight-maker to the Mint, Exchequer, and Bank of England; and that examination of these weights would probably shew what was the metal of which the imperial standard was made.

C. 10. Mr. SCHUMACHER. (Phil. Trans.)

Though we have five different pounds in excellent preservation, and compared with the lost standard with the greatest care and the best instruments, and though the number of these comparisons surpasses 600, there remains an uncertainty of 0.08 grain, or at least, 0.06 grain, as to its real weight; and this solely on account of its specific gravity and expansion not being known.

C. 11. Mr. SCHUMACHER.

You will see by my paper in the "Philosophical Transactions," 1836, that your lost standard troy pound has so carefully been compared with several copies still existing in high preservation (of which a platina copy is in the possession of the Royal Society, and another of the same metal in my own), and the number of the comparisons obtained so great (exceeding 600), that by these copies it might yet be restored with all possible exactness of which the state of the arts renders us now capable, if we only did know its specific gravity. At the same time, I have shewn that this important element can probably yet be ascertained. Mr. Harris delivered in 1758 three copies of the imperial standard troy pound to the Commission, of which they selected one (the last imperial standard troy pound), and invested it with legal authority. Now, most probably, all the three copies were of the same metal, *and two of them are yet existing*. We can therefore ascertain the specific gravity of the *metal* of the two remaining. (I say *metal*, for to ascertain the specific gravity of the copies *as they are* would not be sufficient, as most probably they have hollows in the interior for adjustment, of different volumes). If the metal of both has the *same* specific gravity, we may with great security assume that specific gravity for the metal of the lost standard; if the metal of both is of different specific gravity, all hope to arrive at a knowledge of this element for the lost standard is precluded. The mode of proceeding which I should recommend would be in brief the following:—

1. To ascertain the specific gravities of the two remaining copies, *such as they are*, without touching them in the least,—I mean without making any alteration with them.
2. To cut out of them the largest possible block of *solid* metal, and to ascertain the specific gravity of this metal.

But as long as not all hope is vanished to *restore* the lost standard, I am of opinion that the best way to pursue is, to give a new standard of the same absolute weight as the lost. You are aware that the cutting up of the two remaining copies is only necessary as a proof for the identity of the metal.* Will you grant this identity, they can remain unhurt.

* This identity is not proved when Δ is found = Δ' . The hollow space in the pound made of a more dense metal, can be greater than the hollow space in the less dense pound, and compensate the different densities of the metals.

C. 5*. Captain KATER.

In the "Philosophical Transactions" 1831, Captain Kater has given an account of the construction and verification of a copy of the imperial standard yard made for the Royal Society. It was compared with the late Parliamentary standard 36 times, by means of an apparatus furnished with micrometer microscopes.

SECTION D.

EXTRACTS RELATING TO THE EXPEDIENCY OF PRESERVING ONE OF THE FORMER MEASURES
AND ONE OF THE FORMER WEIGHTS UNALTERED; WITH NOTES ON THE ERROR THAT MAY
IN PRACTICE BE TOLERATED.

D. 1. Mr. BATE.

Recommends that the yard and the pound avoirdupois remain as they are.

D. 2. Mr. BIDDELL.

I think that every one will agree with you that one of the present measures [of length] must be preserved.

D. 3. Mr. BIDDELL.

I do not see that any change in the measures [of capacity] will signify to brewers, wine-merchants, &c., only as relating to their present stocks.

D. 4. Mr. BROWNE.

Whatever mathematical nicety may be necessary in the first formation of a weight or measure, that is soon lost in practice. To illustrate this, suppose the Bank scale and weights to be absolute perfection, and mine to be the same. I have occasion to sell the Bank a bar of gold, say 15 lbs. weight. It is the custom of the Bank to have a certain turn in their favour in buying; and, if they send the same into the Mint to be coined, a certain turn of the scale is there required. Now, in the Bank transactions, no weight is allowed less than 12 grains; so if my weight and scale indicated 15 lbs., it would not pass at the Bank, unless 12 grains were deducted. Now, it would be possible that my 15-lb. weight might be 3, 6, or 9 grains light, and yet the selling the 15 lbs. of gold to the Bank would be one and the same thing. In the same way silver is estimated; and, in 1000 oz. bar, half-an-ounce is the turn usually given and taken: so extreme accuracy is not required.

D. 5. Mr. CUBITT.

With regard to the amount of error which can be tolerated in any of the different measures, this admits of almost as many answers as there are purposes to which measures can be applied, and depends so much on the nature of materials, the perfection of workmanship, the sense of individuals for the appreciation of quantity, and many other considerations, that no definite answer can be given unless a case be definitely put, because in some cases I should think a thousandth part of an inch a greater error than in others a hundredth part of a foot would be.

I have heard of surveyors' chains differing as much as 3 inches! but this I should think an extreme case. In measuring a mile with a common chain by two indifferent surveyors, I

SECTION E.

EXTRACTS RELATING TO THE EXPEDIENCY AND PRACTICABILITY OF ALTERING THE ENGLISH SCALE OF WEIGHTS AND MEASURES GENERALLY: WITH NOTES ON THE MEASURES, &c., MOST GENERALLY USED.

E. 1. Mr. BARRY.

A day or two after receiving thy letter on the subject of weights and measures, I acknowledged its receipt for the purpose, chiefly, of stating, that although for myself I entertained no doubts upon the questions it contained, yet I should prefer conferring with some other houses of business. This I have now done, not confining the calls to those engaged in chemical manufactures; and the reason for this was, that in the oil and wine trades, more particularly where it is customary to ascertain quantities by gauging, it seemed possible there might be derived some advantage, which I could not at that time perceive, from establishing a new relation between the cubic foot of water and its corresponding weight. The result has been that not one of the intelligent and respectable parties who have been consulted, has pointed out any practical advantage to be attained from the proposed alteration—and all of them are desirous to avoid the inconveniences of a change.

E. 2. Mr. BARRY.

I think that there is no important advantage to be gained for commercial or manufacturing purposes, by making the relation more simple than it is at present, "between the weight of water and the corresponding capacity, (expressed by means of the measures of length,)"—these latter words of the question being understood to refer to "measures of length employed to ascertain cubic contents," as in the operation of gauging.

If there were any little advantage to be gained by any change, it would be immensely outweighed by the evils attending an alteration of so extensive a bearing as that of the imperial weights and measures. The enormous expense entailed upon the country (of which even the smallest tradesman employing measures of capacity or weight would have to take a share), would be one of the least of those attendant evils. Among the various intelligent men of business with whom I have conversed upon the question, there is not one, who does not discourage the idea of a change of the kind, to produce, as they conceive, no practical good.

It is very convenient that the gallon of water should weigh exactly 10lbs. [avoirdupois]. Among other advantages it enables any one to examine the correctness of his weights by means of measures; and the correctness of his measures by means of weights.

No material convenience, so far as I have been able to learn from persons engaged in manufactures or commerce, (and more particularly those in the wine, oil, and spirit trades,) could result from causing the cubic foot of water to represent exactly 1000 ounces; that number of ounces is not the equivalent of any certain number of pounds, nor a convenient fractional part of 112 pounds weight, or of the ton, the ordinary weights used to ascertain and to express all large quantities.

E. 3. Mr. BARRY.

In reply to this question—Is it desirable that the avoirdupois weight alone should be altered, so as to make a cubic foot of water weigh exactly 1000 ounces, destroying the relation between the gallon and 10 lbs. weight of water? Or is it desirable that both the avoirdupois weight and the gallon should be altered so as to make the cubic foot of water weigh 1000 ounces, and to preserve the equality of the gallon of water to 10 lbs. weight?

Mr. Barry gives the following answer.—It would be difficult to choose between these two evils. If alteration of the weight were inevitable, it might be best to extend that alteration to the measure, also, so as to preserve the equality of the gallon of water to 10 lbs. weight. But then it would involve such consequences as to create great dissatisfaction. The alteration, it is true, would be slight, say $\frac{1}{350}$. This quantity, however, would amount to a great deal in large transactions, such as those in corn.

But it is especially because of the confusion and distrust that we should endeavour to avert the suggested alteration. In order to know how any alteration would be viewed by those engaged largely in the corn trade, I asked the opinion of the respectable firm of Scott, Garnett, and Palmer.

One of the benefits derivable from the simple relation of the imperial gallon of water to the avoirdupois pound, consists in the facility at all times of examining *measures of capacity*, by means of the weights at hand, without (in the first instance) requiring comparison with county or borough standards: and *vice versâ* as it regards any questionable weights. This benefit is invaluable. Had the imperial gallon been fixed at 8 lbs. avoirdupois of water, (at the standard temperature,) the simplicity of the relation would have been still more perfect for this one object.

E. 4. Mr. BATE.

Allow the suggestion (if no alteration is to be made in the present system of weights,) of dividing in future the pound weight into 6400 equal parts; which by the already easy and generally understood method of halving and quartering, would bring the subdivisions of the pound down to a drachm without fractions:—should an Act of Parliament declare the pound avoirdupois to be divided into 6400 parts, instead of as at present into 7000 parts, many objections to having two dissimilar pounds (as troy and avoirdupois,) might possibly be rectified, though the value of the grain would be altered; in this case, the present grain would be as 35 to 32 of the proposed ones: still (as is most desirable) the present avoirdupois weight now in general use might be retained, and the troy with more facility abandoned, which latter is seldom used except by practical men, (already familiar in assimilating other and foreign weights to their own,) and compounders of medicines.

E. 5. Mr. BATE.

Recommends the abolition of (nominal) measures of capacity, larger than the gallon.

E. 6. Mr. BATE.

As a liquid measure, the pint is, in our opinion, most generally employed: but as to dry measures we cannot say what is the usual practice.

E. 7. Mr. BIDDELL.

The obstacles opposed to the alterations are very formidable, and I do not think will be overcome; but suppose the attempt determined upon, it strikes me that it is impossible to adopt a standard which will bring into one set of measures and expressions, the convenience of the mass of British people, the scientific, geographical, and nautical miles, and the French scale of measures and lengths. If the former could be sacrificed, I understand (from your letter) that

E. 7. Mr. BIDDELL—*continued.*

the two latter could be easily adapted to each other. The scientific people, and those connecting French and English commerce, could much more easily adapt irregular standards to each other, than the great body of British subjects could find by calculation equivalents to lengths and measures which they had not been used to. I therefore think that if the three things before-mentioned cannot be brought into easy correspondence with each other, vulgar convenience must be consulted with the least vulgar inconvenience.

E. 8. Mr. BIDDELL.

I am of opinion that our measures of length must have their foundation in the present Statute chain. By that measure, from the time of Edward VI., the surface of the kingdom has been calculated, and every plot of ground measured and recorded individually and collectively in some writings or other. By that chain are all the expensive tithe surveys going on throughout the kingdom.

E. 9. Mr. BIDDELL.

If the chain be given up, the next measure in practical utility to be retained would be the foot; and whether this is retained or not, it will be of all old measures the most difficult to abandon in the present generation of carpenters, &c.

E. 10. Mr. BIDDELL.

It is questionable with me whether measures greatly differing from the present feet and inches, would not be more easily put in practice, and occasion fewer errors, than a deviation from the inch, so small as to be scarcely perceptible until it be multiplied, (as it would be in measures of capacity, so far as I can now see). A considerable alteration would be far preferable.

E. 11. Mr. BIDDELL.

The alterations here of the yard in linen and woollen drapers' shops would not be much felt beyond the selling off a stock on hand, for none of their wares are of the same width, nor have they any given quantity of materials on a given superficies; the working carpenters would be more put out than any other persons. They are accustomed to measure by feet and inches; and their mode of estimating things without measure, is by those expressions so strongly impressed upon their minds, and confirmed by habit in action, that it would take many years to get them into other habits. The same observation will apply to any thing, where men have accustomed themselves to express their ideas by a given weight or measure. I remember once an instance of this sort which occurred in Essex. Conversation and different opinions led to a considerable wager about the weight of a remarkable beast. There was no means of weighing it, and the disputants agreed that their wager should be determined by the majority of three opinions of good judges, selected in the fair. These were an Essex grazier, a London stock-salesman, and a Suffolk butcher. They were not to converse, but each to write his estimation of the weight. The first could only estimate by "scores" (meaning scores of pounds); the second by stones of 8 lbs. each; and the third, by stones of 14 lbs. each. The wager was made as to the beast weighing so many cwts. When the opinions were announced, none of the interested parties could tell, nor could either of the three judges tell, who had won the wager—nor could they tell, for a long time, which of the three had estimated the beast at the greatest weight, and they each declared they could not form the least idea of the weight, only in their own way. Such is the force of habit—and that force would occasion vast opposition to an alteration in measures relative to lengths—but the weights and capacities of measures would occasion very little inconvenience by their alterations.

E. 12. Mr. BIDDELL.

I do not see that any change in the measures will signify to brewers, wine-merchants, &c., only as relating to their present stocks.

E. 13. Mr. BIDDELL.

As to measures of capacity in a country abounding in measurable dry goods, and particularly that of corn, which is subject to more manual portorage than anything else—three quantities are essential to be preserved; such as, in weight and bulk, will correspond with the average strength of men's hands, arms, and backs. The peck, the bushel, and the coomb, are found to correspond well with man's strength in these particulars, and yet will admit of all the reasonable variations which you will require. But when you consider how much corn has to be measured and carried upon men's shoulders, and how often every grain of corn has to be so measured and carried, you must not forget to retain something like the present bushel.

E. 14. Mr. BIDDELL.

If the bushel be composed of 10 cube links [?] it would be less than the present bushel, and consequently, as we farmers all agreed that the enlargement of the bushel decreased our produce, a new bushel made less than the present one would increase our produce, and please us. However, we could not be so pleased without an uncommon disturbance of weights and measures; but as these would be all rather less than the present, the immense expense to which the country was put in 1825, by having these things enlarged, would be no criterion for the expense of having them reduced, at least it appears to me that they might be made conformable to any reduced new standard at a comparatively small expense. The root of the measures or weights in the above proposition, would *not* be simple, which is one of the objections to the present standard; and there would be the same trouble as now in restoring it, if lost or destroyed; and there must be great scientific accuracy and trouble in restoring any, at least I cannot suggest any that would be simple. If the standard chain is to be disturbed, I would make no great hesitation in forming an entire new standard of measures and capacities and weights, entirely depending upon one another, such as might unite science with common names and things, and both with what should be considered the most essential and permanent foreign standards.

E. 15. Mr. BIDDELL.

In fact, the alterations so much wanted are, to have measures of small capacity easily deduced from lineal measure, and it is *infinitely* of more importance to have small capacities measured easily than large ones. Where the cubical content of Jupiter or the earth is measured once, there are, for ought I know, as many pecks and bushels measured as might make up the bulk of a planet.

E. 16. Mr. BLACKBURN.

The butchers throughout the country, but more especially in London, buy and sell meat by the old stone of 8 lbs., although the late Act of Parliament is expressly clear upon this point, declaring 14 lbs. to be the only stone weight.

E. 17. Mr. BRIGHT.

We have no idea that any alteration in the present weights used in commerce would be of any advantage, but would create mistakes and frequent disputes; the repeated alterations that have been made in the names of a great many drugs and chemical preparations, have occasioned a deal of trouble and frequent mistakes, without being of much benefit to any one.

E. 18. Mr. CHILD.

The measures of capacity most in use are pints and quarts: those of length, are, I think, the two-foot rule, also four and five feet.

E. 19. Mr. CUBITT.

The general unit of measure in the construction of mill-work is the *foot* divided into "inches" and eighths of an inch, and again subdivided into sixteenths by the eye in reading off, or in expressing the dimension. Thus we say—ten feet seven inches and a half; seven feet six inches and three-quarters; eight feet ten inches and a quarter; six feet four inches and an eighth; or three eighths; or five eighths; or seven eighths, as the case may be; never reading two eighths or four eighths, or six eighths, for the half and quarters, and generally saying "and a sixteenth" when it occurs, instead of stating the whole number of sixteenths; thus we say, "two and three-quarters and a sixteenth," instead of "two inches and thirteen sixteenths;" but in speaking of the thickness of sheet or plate iron, &c., it is common to say three sixteenths or five sixteenths.

The denominations referred to for the erection of gas-works and the like, are the foot for all that relates to the buildings, apparatus, and machinery, the yard for laying down the main pipes.

The denominations referred to for the erection of bridges, harbour piers, and similar exposed works, are the *foot* generally; sometimes the cube yard in estimating the contents, but then it is deduced from the foot as the basis of the admeasurement, or scale of the plan.

The length of a railroad or canal is commonly expressed by engineers by the mile.

The breadth and depth of cuts or embankments are commonly expressed in feet.

The solid content of an embankment is computed by the foot, and cast out into cube yards to express its content.

In making a contract for an earthwork, the cube yard is considered as the unit of the contract.

In making a contract for iron rails upon a railroad, the ton weight is considered as the unit of contract.

It is usual to estimate the size of rails by the weight per yard. But it is not usual to contract at per mile for iron rails, or for the execution of works generally; but it is not unusual to contract for surveys of a line of railway or canal, or the levelling and making a section of the same, by the mile.

In making a contract for massive erections of piers, bridges, &c., the following denominations are considered as the unit of contract.

The cube foot and the cube yard are both used, depending on the nature of the work; for "ashlar," or squared stone-work, generally the cube foot; for rough hammer-dressed work, backing, &c., the cube yard; brick-work by the reduced rod, which means that which is equal to a square rod ($16\frac{1}{2}$ feet square) one and a half brick thick, or 306 cube feet, or by the cube yard.

Walls of buildings are contracted for by the reduced rod; floors or paving either the *square*, the square yard, or the square foot; roofing and slating, the *square*; lead or zinc covering, the cwt., or by the square foot at a given weight per foot; wood-work generally by the cube foot; plastering by the square yard; the windows by the square foot, separate for the frames and the sashes.

E. 20. Mr. CUBITT.

There is but little difference in the usages now in distant parts of the country compared with what there was even in my recollection; the increased and increasing facility of intercourse, brings all those matters to a uniform mode of expression. London architects, and London builders and contractors, have given a great uniformity to everything connected with building

E. 20. Mr. CUBITT—*continued.*

in every part of the country, so that there is very little difference with regard to denominations of measure; and whenever local terms occur, they are invariably referable, I believe, to the foot as the unit of measure.

E. 21. Mr. CUBITT.

The most convenient subdivisions of length appear to be the following:—The foot divided decimally as the unit of measure for those who pursue calculations and investigations of a scientific nature; and divided into inches and eighths for all working and practical purposes; the yard is not much used as a unit of measure, and the fathom still less, but they must still be retained for their peculiar practical purposes; the seaman would be a long time in estimating the depth of the sea in any other measure than fathoms, and the smallest division he wants is “quarters.”

E. 22. Mr. CUBITT.

I would expel nothing, but make the *foot* the *standard* or *unit of lineal measure*, however numerous might be its multiples under different names, for different purposes, for the sake of convenience, in terms of yards, fathoms, chains, poles (or rods), miles, &c., &c.

E. 23. Mr. CUBITT.

Although I do not think a change impracticable throughout the country, should good cause be shewn for a change, yet I think the good to be obtained by any extensive alteration would not compensate the evils or difficulties in obtaining it.

E. 24. Mr. CUBITT.

On the whole I feel that alterations and innovations with regard to weights and measures should be well considered and cautiously made, particularly as regards measures; and I think that the *foot* should be the unit of all linear measure, and the *standard basis of length, weight, and measure of capacity*, by making perfect and legal that which is now so very near, viz., that a cubic foot of distilled water, at a given temperature, should be taken to weigh exactly 1000 ozs., and that 16 such ounces should constitute the legal pound weight as the *unit of weight*, and 10 of such pounds should be the legal gallon as the *unit of measures of capacity and liquid measure*.

E. 25. Mr. CUBITT.

There would be great difficulty in change, begin at which end we will, and after all the result would be mere approximation; I should be sorry to see the foot or the ounce weight or the gallon altered from the present standard, inasmuch as a cubic foot of water weighs 1000 ozs., and a gallon of water just 10 lbs., or so near those proportions, that being legally made so (and which I think is worth doing), it would be as good an assimilation of weights and measures for all practical purposes as could be devised.

E. 26. Mr. CUBITT.

In measures of capacity, for liquids and corn, the gallon containing 10 lbs. of water (as above stated), should be considered the standard unit of wet and dry measures, all the multiples and divisions of which should retain their present names and relations.

E. 27. Mr. DE GRAVE.

I should think the measures most used, were the bushel and peck for corn; and for liquids, the quart and pint.

E. 28. Mr. GILBERT.

I am decidedly against the slightest change for any of these purposes [simplifying the mutual relations of English measures, introducing decimal scale, referring more nearly to a natural standard, simplifying the relations with the standards of other countries]. Decimal multipliers and logarithms offer such facilities of conversion, that the perfection of bringing our standards to any national or foreign measure would be little more than ideal; while the confusion introduced is great and permanent. The Saxon pole is 18 feet: the Normans, for some unknown reason, reduced the pole to $16\frac{1}{2}$ feet; and after the lapse of 750 years, the two measures co-exist and perplex all statements relative to land.

E. 29. Mr. GINGELL.

Allow me to give you my idea of a scale for lineal measure for your consideration. Gunter's chain must be re-modelled.

10 Parts	to be	1 Link.
10 Links	„	1 Foot.
10 Feet	„	1 Perch.
10 Perch	„	1 Chain.
10 Chains	„	1 Furlong.
10 Furlongs	„	1 Mile.

E. 30. Mr. GINGELL.

It would be desirable there should be but one weight instead of three. The apothecaries' and troy pound and ounce being the same, except differently divided and sub-divided (which is complicated and liable to create error), these two weights may be classed as one. The avoirdupois being a distinct weight, equal to $1^{\text{lb.}} 2^{\text{oz.}} 11^{\text{dwts.}} 16^{\text{grs.}}$ troy, which is decidedly bad, of two evils choose the least; in this case the troy must give way to the avoirdupois, or create a new scale. I here take the liberty to submit a *new scale* for your consideration, which I think will meet the whole of the various classes, and in its most simple form. Every person must admit the grain to be the foundation or standard of all weights, the avoirdupois being 7000 of these grains, and the troy 5760 grains. To work out the new scale, take the mean between these two, 6380, and for the sake of simplicity to gain even numbers, add 20, which will produce 6400 equal parts or grains.

My new scale stands thus:—

6400 Grains shall contain 16 ounces, 1 lb.	200 Grains shall contain $\frac{1}{2}$ ounce, 8 drachms.
3200 „ „ 8 „ $\frac{1}{2}$ lb.	100 „ „ $\frac{1}{4}$ „ 4dms.
1600 „ „ 4 „ $\frac{1}{4}$ lb.	50 „ „ 2 dms.
800 „ „ 2 „ 2 oz.	25 „ „ 1 dm.
400 „ „ 1 „ 1 oz.	$12\frac{1}{2}$ „ „ $\frac{1}{2}$ dm.

This is an easy scale to divide and sub-divide, and not differing very materially from the whole of the three classes of weights above-mentioned, and being suitable to the precious metals, drugs, or general merchandise; the parts below this scale of $12\frac{1}{2}$ grains (being equal to the half drachm, which is the smallest weight in avoirdupois used or legalized in her Majesty's Exchequer for general purposes) may be called "grains," as the case may be; and for scientific or mathematical purposes, the "grain" is further reduced to $\frac{1}{1000}$ of a grain. The drachm, the scruple, and the pennyweight, may be entirely abolished; and the only weights known or recognized in the selling or buying any commodity or thing, should be some multiple of the above scale.

Since the introduction of the Imperial Act, which has not abolished all other weights and measures, there has been great irregularity with apothecaries and druggists in compounding medicine. This will be seen by observing the various publications connected with this profession. For instance, the leading one is the New London Pharmacopeia, which quotes im-

E. 30. Mr. GINGELL—*continued.*

perial weight and measure for liquids and solids, yet the bottles used by the compounders are still made and sold to the old wine measure standard, which is both inconsistent and dangerous to the public. There are apothecaries and druggists, some possessing imperial weights, others the old medicinal weights, and both are compounding prescriptions, some by the *new*, the others by the *old* weight and measure.

E. 31. GLASGOW COMMITTEE.

They would humbly recommend the adopting the Exchequer gallon of 270 cubic inches, by which a simple system would at once be obtained, and which measure was pressed upon public attention by the late Dr. Rotherham, when this question was agitated in the year 1791; and by Professor Playfair, when it was again agitated in the year 1812. If this gallon were to be adopted, the bushel would then be 2160 cubic inches, or $1\frac{1}{4}$ cubic foot, and the quarter 17280 cubic inches, or 10 cubic feet.

E. 32. GLASGOW COMMITTEE.

The divisions certainly may be preserved, and ancient usage continued; but it would be proper, the Committee think, to adopt the binary scale, or a series in geometrical proportion, the common ratio 2, and thus render their relations obvious, as

Parts of the Gallon for Liquids.							Unit Gallon for Liquids and Dry Goods.	Multiples of the Gallon for Dry Goods.						
Gallons . .	$\frac{1}{84}$	$\frac{1}{32}$	$\frac{1}{16}$	Pint. $\frac{1}{8}$	Quart. $\frac{1}{4}$	$\frac{1}{2}$	1	2	4	Bush. 8	16	32	Qr. 64	Gallons.
Cubic Inches	4.21875	8.4375	16.875	33.75	67.5	135	270	540	1080	2160	4320	8640	17280	Cubic Inches.
Cubic Feet .	.002441	.004883	.009765	.019531	.039062	.078125	.15625	.3125	.625	1.25	2.5	5	10	Cubic Feet.

E. 33. GLASGOW COMMITTEE.

The following Table exhibits the relation that would be established between our weights and measures, were they to be adjusted upon this plan:—

		Number of Gallons in each Measure.	Cubic Inches.	Cubic Feet.	Ounces,* Avoirdupois, of distilled water, at the temperature of 62°	Relative Measures in French.
Gallon and its parts <i>Note.</i> —These will be used for Liquids.	One-eighth of a pint = ten times the cube of $\frac{3}{4}$ of an inch = $75^3 \times 10$. . .	$\frac{1}{84}$	4.21875	.002441406	2.44141	.06913
	One-fourth of a pint	$\frac{1}{32}$	8.4375	.004882812	4.88281	.13826
	Half-pint	$\frac{1}{16}$	16.875	.009765625	9.76562	.27651
	Pint = ten times the cube of $1\frac{1}{2}$ inch = $1.5^3 \times 10$	$\frac{1}{8}$	33.75	.01953125	19.53125	.55303
	Quart	$\frac{1}{4}$	67.5	.0390625	39.0625	1.10606
	Half-gallon	$\frac{1}{2}$	135	.078125	78.125	2.21213
Gallon and its Multiples <i>Note.</i> —These will be used for Dry Goods.	Imperial standard gallon = ten times the cube of 3 inches = $3^3 \times 10$. . .	1	270	.15625	156.25	4.42426
	Peck	2	540	.3125	312.5	8.84852
	Half-bushel, or two pecks	4	1080	.625	625	17.69705
	Bushel = ten times the cube of 6 inches = $6^3 \times 10$	8	2160	1.25	1250	35.39411
	Two bushels, or double-bushel	16	4320	2.5	2500	70.78822
	Half-quarter, or four bushels	32	8640	5	5000	141.57644
	Quarter = ten times the cube of 12 inches = $12^3 \times 10$	64	17280	10	10000	283.15289

* Each Ounce is $436\frac{1}{4}$ Grains.

E. 33. GLASGOW COMMITTEE—*continued*.

To connect measures with weights, the standard ounce ought to be the weight of the 1000 part of a cubic foot of water, and in the following Table there is offered a similar scale for weights to the one given above for measures:—

Lb.	drn. $\frac{1}{256}$	$\frac{1}{128}$	$\frac{1}{64}$	$\frac{1}{32}$	oz. $\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	lb. 1	2	4	8	16	32	64	128	256	512	1024	2048	lbs.
Oz.	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8	16	32	64	128	256	512	1024	2048	4096	8192	16384	32768	oz.
Grs.	27.25	54.5	109	218 $\frac{1}{8}$	436.25 <i>a.</i>	872.5 <i>b.</i>	1745 <i>c.</i>	3490	6980												

a. The weight of the new Coinage is, a Crown, or 5s. = 436.36 grs., and 1s. = 87.27 grs.

b. " " two ditto, or 10s. = 872.73 grs.

c. " " four ditto, or 1l. sterling = 1745.45 grs.

E. 34. GLASGOW COMMITTEE.

The multiples of the pound avoirdupois, or the weights known by the name or denomination of the stone of 14 lbs., the hundred-weight, which has gradually varied from 100 lbs. to 112 lbs., and the ton, commonly rated at 2240 lbs., are not mentioned or recognized in the statute 5th Geo. IV. cap. 74. They are suppressed, or extinguished, and set aside as unnecessary and useless; and, in particular, the stone of 14 lbs. is for ever abolished.

Yet all the above useless multiples of the pound, and many improper local weights, wisely intended to be abolished, are still continued, so that the utmost confusion and perplexity, and probably frauds, generally prevail. Additional intricacy and confusion have also arisen from inattention to clauses of the Act relating to the construction of tables of equalization, under the authority of the Treasury, shewing the true proportions between the old and new standards, in terms of the 19th section. These tables might have been published in 1827, and ought to have specified what old weights are now abolished, and what are the existing standards. In fact, the statute has never been regularly promulgated, and the public are not informed that the usual ton, hundred-weight, and stone (multiples of the avoirdupois pound), are suppressed as useless, and no longer of any authority.

It is not generally known that the Acts which authorized the stone of 14 lbs. are, to all intents and purposes, *for ever repealed*, and that this weight is by law abolished. However, instead of being extinguished, it is prevailing in some parts of Scotland, in consequence of recent innovations, to greater extent than formerly: has been absurdly placed in the columns of important public accounts; and is unwarrantably employed by the retailer of meal in great cities, who denominates this illegal stone of 14 lbs. to be *two* imperial, or new pecks of 7 lbs. each, a denomination of weight not existing in any statute. In this case, there is reason to believe, much deception is practised, and it is feared that the working classes, who purchase meal in small quantities, are frequently defrauded; so that although the Act of Parliament was intended for the security of commerce, by establishing uniformity throughout the Empire, yet the object is not attained. It is intended, by the 5th clause of Lord Ebrington's Bill, to revive this improper weight of 14 lbs. and also to restore its useless multiple, 112 lbs.; thus two very inconvenient quantities will be placed among the many denominations of our present complex system of weights. In this new Bill, as amended by a committee, it is declared that the "stone weight in the country is generally deemed to contain 14 pounds avoirdupois, and in London 8 of such pounds;" and it is to be "enacted that there shall be but one weight called or known by the denomination of stone, and that such weight shall contain 14 *imperial standard pounds avoirdupois*, that being a good multiple of, and forming one-eighth part of the *imperial avoirdupois hundred-weight*" of 112 lbs. The framers of this Bill are certainly not aware

E. 34. GLASGOW COMMITTEE—*continued*.

that there is no statutory weight, called “the *imperial avoirdupois hundred-weight*.” Their meaning is, that the number 14 is a *sub-multiple*, or one-eighth part of 112, commonly called the hundred-weight. It is obvious that the quantity 112 is measured by 14, and also by *more convenient numbers*, namely, by 8 (the pounds in the London stone), and by 16, the pounds in the usual stone, which also expresses the common ratio in the avoirdupois scale: these, however, are not sufficient reasons for restoring denominations wisely abolished.

E. 35. Mr. GODFREY.

We cannot desire or advise any further alteration of the standard. The country is gradually acquiring uniformity, notwithstanding the 15th section of the 5th Geo. IV. c. 74; the evils of change have been encountered and are gradually being overcome, and we should deprecate any further alteration in this respect, as highly inconvenient.

E. 36. Mr. HARLEY.

The present sub-divisions are good and work well.

E. 37. Mr. HARLEY.

The most usual measure is imperial, all other being abolished by the statute 5 and 6 Wm. IV. cap. 63; still many kinds of customary measures are often met with, such as the “can” the third of a quart, the “tankard,” three-fourths of a quart, &c. &c.

E. 38. Dr. LAMONT.

I do not find that the Commission of Weights and Measures (of whom the principal person was Professor Schleg), expressed any desire of introducing a more regular system [in Bavaria.]

E. 39. Dr. LAMONT.

It was thought prudent, after what had been experienced in France, to retain the *old divisions* and *old denominations*, though the magnitudes were changed. The equalization of weights and measures has been effected in Bavaria by means that in Britain would be of no avail, the circumstances being totally different. The Bavarian Government merely took care that the new weights and measures should be used in *all* public business, and in *all* public transactions; and that in every district of the kingdom, copies of them could be had without any difficulty, while the old were ordered to be sent to Munich and preserved in the archives. No compulsory means whatsoever were used, or were requisite for inducing the people to adopt the new system; it was a necessary consequence of the constitution and customs of the country, and of the frequent and various relations of individuals with the public authorities, that the new system became *generally known* within a very short time; and that it was found convenient, if not necessary, to adopt it. Interest and convenience overcame, in time, prejudices which it would have been difficult to overcome by fines and penalties.

E. 40. Dr. LAMONT.

The system of weights and measures defined by the Royal Decree of 1809, could not, on account of the war that soon broke out, be immediately brought into general use; a considerable delay was afterwards occasioned by the circumstance, that the Commission of Weights and Measures employed much more time than had been anticipated to furnish the public authorities of the towns and districts of the kingdom with accurate copies of the new weights and measures, to be used and preserved by them as originals for copying or local standards (*Mutter-maasse*). Thus the new system was not introduced before the 1st Oct., 1811.

The number of public authorities furnished with the copies just mentioned, was 281; the total number of copies furnished, nearly 3000. The copies were one foot measure of iron (tried in a

E. 40. Dr. LAMONT—*continued.*

mould and stamped by the commission); one yard measure (verified and stamped in the same manner); one pound weight of brass, with its subdivisions; and cast-iron weights of 5-100 lb. (the latter only for the principal towns); one maass-kanne, being a hollow cylinder of brass or tinned copper (examined and adjusted by the weight of the water it contained); one metzen (corn measure), with its subdivisions; for the principal towns, of tinned copper; for other places, of oak wood with iron hoops and painted, (examined and adjusted in the same way as the maass-kanne).

After these copies had been distributed, new weights and measures were made and sold in all the towns and considerable places, the public authorities having been directed by Government to give the necessary encouragement to all those who occupied themselves with making or selling weights and measures. At the same time the old standard of the different towns and provinces, were ordered to be sent to Munich and preserved in the archives, so that it became impossible to obtain authentic or stamped copies of them.

It may be easily judged that the common people, particularly in the provinces newly united with Bavaria, were little inclined to adopt the new system. Government did not directly oppose their prejudices; there was no question of fines or disadvantages for not using the new system; it was merely ordered that the new system should be used by all public authorities, and in all public business. This was done without difficulty or opposition. The expenses of introducing the new system of making, comparing, and transporting the standards, were paid from the public revenues. Neither communities nor individuals were directly put to expenses; for nothing exasperates the people more than being obliged to pay for what they consider to be a useless innovation. Though so little was directly done by Government, yet the course that had been chosen was well calculated to produce in the space of a few years the desired effect, a general uniformity of weights and measures. To conceive this, the constitution of the country, together with local circumstances and local customs, must be considered. In consequence of the new weights and measures being adopted by the public authorities, they were used in the numerous contracts by which different articles are furnished for Government in all parts of the kingdom, and in the many works or undertakings carried on at the expense or under the superintendence of Government (including everything that is not the exclusive property of individuals); in both cases a number of people take part. The new system was used in all contracts, sales, &c., concluded before a magistrate; it was introduced in the excise and similar duties. The new measures were applied in receiving the imposts or taxes on landed property, payable *in natura* (particularly corn); in the towns there are, for the convenience of buyers or sellers, people appointed or licensed by the local authorities to weigh and measure (employed at corn-markets, hay-markets, &c.); these of course immediately adopted the new weights and measures. From these and similar circumstances that might be mentioned, it will appear that a great part of the people were for their own interest under the necessity of becoming acquainted with the new system and frequently of using it; the last-mentioned circumstances, in particular, will explain how the agricultural class (for the most part cultivators, and at the same time proprietors, of the soil, very numerous and very difficult to be accustomed to any kind of innovation), became familiar with the new weights and measures.

It was of considerable importance that the old standards were removed to Munich, it being thereby rendered impossible to obtain stamped copies of them; while in this country a number of public dealers, to prevent fraud, are required to use *stamped* weights and measures.

It may be remarked that it is less difficult in changing weights and measures to substitute different quantities, than to substitute different names and introduce different divisions. In

E. 40. Dr. LAMONT—*continued*.

Bavaria the common names and divisions were left unaltered. Frequently the people have applied local names to quantities, very different from what they originally meant; thus, $\frac{1}{2}$ maass is termed at Ratisbon and the neighbouring country "leidl," a measure formerly very different from half a maass. A number of similar instances could be adduced. This circumstance might be applied with advantage in a country where very different dialects are spoken, and different weights and measures used. The local or provincial names could be *sanctioned by law* and nearly new quantities substituted, these quantities being subdivisions and multiples of the common unity, and chosen so as to approach to the old quantities as nearly as possible. No attempt having been made by the Bavarian Government to exclude the old weights and measures in the private contracts, and transactions of individuals, merely inconvenience could prevent their use. The inconvenience augmented as the use of the new system grew more general; even the trades that by their nature have little connexion with general commerce, conformed themselves by degrees to the new system; and at present, as far as I can learn, use it generally, with the exception of the cartwrights, who all over the country still employ the Austrian foot (Vienna foot). The old yards (cloth measure), of the different provinces were for many years (and may still in some places be) found in the shops beside the new yard, to be used according to the wish of the buyer.

The official papers which I have perused, afford no information on the subject just mentioned, interference in this matter being foreign to the purposes of the Government.

It must be mentioned that the excellent system of general uniform education so successfully introduced in Bavaria, greatly facilitated the introduction of uniform weights and measures.

E. 41. Mr. PARKER.

Proposes the following scale of measures of capacity:—

	In.	In.	In.	Cub. in.	Shape of Measures.
Quarter-pint	2	×	2	×	2 = 8 Cube.
Half-pint	4	×	2	×	2 = 16 Double cube.
Pint	4	×	4	×	2 = 32 Half-cube.
Quart	4	×	4	×	4 = 64 Cube.
Half-gallon	8	×	4	×	4 = 128 Double cube.
Gallon	8	×	8	×	4 = 256 Half-cube.
Peck	8	×	8	×	8 = 512 Cube.
Half-bushel	16	×	8	×	8 = 1024 Double cube.
Bushel	16	×	16	×	8 = 2048 Half-cube.
Double bushel	16	×	16	×	16 = 4096 Cube.

E. 42. Col. PASLEY.

Proposes the following scale:—

10 parts = 1 digit.	:	10 digits = 1 foot.
10 links = 1 fathom.	:	10 fathoms = 1 chain.
100 chains = 1 mile.	:	60 miles = 1 degree.

And—

1000 square fathoms	=	1 square acre.
1000 acres	=	1 square mile.

E. 43. Col. PASLEY.

Proposes—

5 pints	=	1 can = 100 cubic digits.
10 cans	=	1 cubic foot.
10 cubic feet	=	1 quarter of corn.

E. 44. Col. PASLEY.

Proposes to use only the pound and the grain.

7000 grains	=	1 pound.
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E. 45. Mr. REEVES.

In London the two-feet rule, and the yard measure of length are most used. The quarter of a peck is the measure of capacity of which the greatest number come under the cognizance of the inspectors; the fewest in number is the bushel.

E. 46. Mr. REYNOLDS.

The series of weights cannot be better divided than at present, while the standard hundred is 112 lbs.

E. 47. Mr. WADE.

I do not know of any inconvenience in the subdivision of pounds into ounces.

E. 48. Mr. WADE.

The following is a correct list of all the different sorts of weights and measures compared and stamped by me in 12 months, that is, from December 25, 1838, to December 25, 1839.

Brass Weights.			Iron Weights.					Dry Measures.			Length.	Copper Measures.				Pewter Measures.
7, 4, 2, and 1 lb.	Under 1 lb.	Set, 1 lb. and under.	56 lbs.	28 lbs.	14 lbs.	7 lbs. and under.	Set, 1 lb. and under.	Bushel.	Half-Bushel.	Smaller.	Yard.	4 Gallons.	2 Gallons.	1 Gallon.	$\frac{1}{2}$ Gallon.	Quarts and under.
44	2,511	162	1,145	271	500	6,184	25	46	46	846	57	4	2	45	35	41,310

E. 49. Mr. WALKER.

The standard should, I think, be small, as the great proportion of things are by small measures, and it is very desirable to avoid the 0 after the decimal point, and to have the generality of expressions rather above than under a unit.

Would it not be well to have a short word in place of the tenth of an inch? Why should language be so much more liberal to weights than to measures? How would *dece* do for a coinage of a word?

In this country we have an aptitude for abbreviations, which the French have not.

As to square and cube measures, it might be well to have words expressive of their meaning without using the words "square," "cube," on all occasions, which sometimes confuses. We have acre and rood only (so far as at the moment occurs to me), in superficial measures; a "square" which builders use, is 100 square feet; a "floor" amongst excavators is 400 cube feet; the names are bad, but the application of them shows the want of proper terms for superficial and cube measures.

E. 50. Mr. WALKER.

Whenever I go into any county or place, which I had not visited before, my first question is as to the measures and the customs of measuring work, which are as various and whimsical as you can conceive. A page of my memorandum-book generally is set apart for the measures; and I make my specifications conform with them, without which they would be more troublesome to contractors, &c., than converting their perches, floors, squares, &c. would be to me.

E. 51. Messrs. WARNER.

We cannot point out any inconvenience in the sub-division of pounds into ounces or in measures.

E. 52. Messrs. WARNER.

The measures of length most used are the yard and foot; the measures of capacity most used are the bushel, peck, gallon, quart, and pint; the measure of capacity least used is, perhaps, the half-gallon, but they all appear to be wanted for the convenience of trade.

E. 53. *Westminster Review*.

Recommends the following scale :—

10 fathoms	= 1 chain.
10 chains	= 1 furlong.
10 furlongs	= 1000 fathoms = 1 mile.
10 square chains	= 1 acre.
1000 acres	= 1 square mile.

The length of a geographical degree, expressed in these measures, would be 60 miles and 824 fathoms.

E. 54. *Westminster Review*.

Recommends a hogshead of 8 cubical feet, or 50 proposed gallons, weighing 500 proposed pounds: pipe = 2 hogsheads: tun = 2 pipes.

E. 55. *Westminster Review*.

Recommends a new ounce (with the proposed name crown ounce), differing from the troy ounce in the proportion of 10 : 11, and from the avoirdupois ounce in the proportion of 384 : 385; which would exactly represent the weight of five shillings of our present coinage; and would exactly represent the weight of $\frac{1}{1000}$ cubic feet of water, at the temperature 59° Fahrenheit, or 15° centigrade. Proposes that no pound of 12 such ounces should be sanctioned.

E. 56. *Westminster Review*.

States that, in consequence of the imperfection of the Act of 1824, and the sanction of the stone weight of 14 lbs., there are now three kinds of weight in Scotland—with pounds of 14 oz., 16 oz., and 17½ oz.

E. 27*. Mr. DE MORGAN.

I doubt if it can be shewn that the Saxon pole was always 18 feet. The Normans, or rather Parliament by a very early statute, chose 16½ feet from among a great number of different poles, some longer, and some shorter. Ducange (PERTICA) mentions many, and the Benedictine editors add more.

SECTION F.

EXTRACTS RELATING TO THE EXPEDIENCY AND PRACTICABILITY OF ALTERING THE LAND-CHAIN AND THE MILE ; WITH NOTES ON ANALOGOUS MEASURES IN OTHER COUNTRIES.

F. 1. Mr. BIDDELL.

One question I weighed in my mind before to-day, with all the attention I am master of ; namely,—whether any change of measure would produce so much inconvenience as altering the statute chain. I decidedly think that measure must remain the same, and the links in that chain the same, whatever other measures are altered. The national surveys that are so far advanced, the more minute measurement of every yard of land in the kingdom under the Tithe Act, and the former surveys of all private estates, would be deprived of their perspicuity in the eyes and ideas of future generations by altering the statute chain. It is a sort of medium length between little measures and long distances, where the present measures of length and any future new ones might meet and assimilate to each other, by carrying feet and inches upwards, and bringing miles downwards, to the common meeting standard of old and new measures. It is also a considerable length, reducible to inches without fractions, and dividable into halves and quarters without fractions. I think every one will agree with you that one of the present measures must be preserved ; and if that one be the chain, and the subdivisions continue to be the links, the next question would be, how an invariable root for this measure could be obtained ? This is purely scientific, and I know not how you will fix the datum. If the decimal divisions of the chain be destroyed, the future convenience of that measure (convenient now beyond all others) will be destroyed with it ; and my opinion is, that no change could take place, equal, in practical utility to future generations, to divisions of measures purely decimal. Its utility would be greatest to the great and uneducated mass of the people ; who would, when once the measures began, multiply and divide almost without learning any regular rules of arithmetic.

F. 2. Mr. BIDDELL.

I do not think the alteration of the mile to any additional length will be of the least consequence. Even the surfaces of counties are expressed in acres ten times to once being expressed in miles ; and if the chain be not altered, the acre will not require to be altered.

F. 3. Mr. BIDDELL.

Although I have stated that the foot is the measure of most practical utility, and most common use, it is not so much a measure of important record as measures by the chain ; and it will be much easier to assimilate measures recorded by feet to measures by the chain, than to assimilate superficies recorded by chains to measures of feet.

F. 4. Mr. CUBITT.

I see but little inconvenience in the mutual relations of the standards of yards and feet, on the one hand, and chains, on the other hand, as they stand at present,—less certainly than would arise from any attempt at alteration; but in fact, after all, everything, whether yards, chains, fathoms, rods, &c., is referred to the *foot*, which I think may be deemed the unit of measure in this country, however it may be multiplied or subdivided, and by whatever terms its multiples and subdivisions may be expressed.

F. 5. Mr. CUBITT.

I think it better to retain the present chain and the present inch as they are (although fully aware of the imperfection of the lineal system, and its present incongruity), because the *chain* is so very distinct in its application from the *foot*, the first being solely applicable to land and road measure, and the latter to almost all the other purposes of life, that I see but little good to be obtained, from making the component parts of a foot any aliquot part of a chain, when, do what we will, we cannot hope to establish an entire aliquot system of linear measure, however desirable it may appear.

F. 6. Mr. CUBITT.

The chain is already decimally divided, and, as before observed, is so extensively used for its peculiar purpose, as to require or admit of no alteration, nor are any smaller parts than links requisite in its general use.

F. 7. Mr. CUBITT.

As far as engineers are concerned (civil engineers, I mean), I see no necessity for the use or adoption of a chain of 20 yards instead of 22; for if the yard were to be kept at its present length, it would alter all quantities of land in proportion to the squares of the linear dimensions; and anything which would alter that alone would be a great evil; and as the statute mile and acre are now being adopted in Scotland and Ireland, in all public works and surveys, it would never do to make any alteration in the chain so as to affect the content of an *acre*; the length of the *mile* might be altered, perhaps with less inconvenience, by making it a different multiple of the statute foot, without at all affecting land measure, which is a subject in itself.

F. 8. Mr. CUBITT.

If we keep the foot, and consequently the yard, the same, and make a 20-yard chain, we alter the acre and the mile; and if we make the first 12 [square] chains, instead of 10, and the latter 2000 yards, instead of 1760, we should obtain, I fear, confusion in many cases, and exactitude in none; still, I am of opinion that the mile might be altered to 6000 feet, without regarding any alteration of the chain, when it is considered that the “log knot,” or “nautic mile,” is estimated at 6000 feet, which is also a near approximation to a minute of a degree on the earth’s surface.

F. 9. Mr. CUBITT.

The absolute length of a *mile*, as now by law established, might perhaps be altered to 6000 feet or 2000 yards, by legal enactment, but the chain must not, in my opinion, be altered; in short, I see far more difficulties attending the alteration of the chain and the acre, than would obtain by letting the lengths of measures and their denominations, relative to the mile, the chain, and the acre, remain as they now are.

F. 10. Mr. CUBITT.

A mile of 2000 yards, or 6000 feet, would, I think, be more convenient to engineers than the present mile of 1760 yards, or 5280 feet, nor can I see it less convenient for any class of scientific or practical men.

F. 11. Mr. CUBITT.

Reverting again to measures of length, I would keep all the *denominations* the same as at present, and alter the relations of the same to the standard, only in one instance, which is, that the statute mile should consist of 6000 units or feet; and I would leave land measure, with its basis (the chain of 22 yards), just as it is, being so entirely distinct from all other things, and being such a tolerably perfect decimal system in itself, as not to require alteration, as the evils of alteration in that case would, in my judgment, be greater than the advantages.

F. 12. Captain DAWSON.

Captain Dawson considers the relation between the linear chain and the superficial acre so convenient, that no alteration can be made in one, without altering the other.

The ordinary subdivisions, roods and perches, are in some degree inconvenient, as requiring separate multiplication, or the use of tables, after the decimal operation, and as giving greater trouble in addition. The measures of fields are commonly made from paper dimensions; the conversion from decimals into roods and perches is made for each particular field.

Captain Dawson, in capacity of Superintendant of Surveys relating to the Tithe Commutations, has had experience in every part of England; so far as he knows, the statute acre is universally used in England.

The Tithe Commutation Act requires that statute acres shall be used in the returns to the Tithe Commissioners; yet Captain Dawson thinks that he should, in all probability, be acquainted with the customary measure.

Captain Dawson has never known an instance of the use of any other than the statute acre.

Old maps are frequently sent to the Tithe Commissioners, and adopted for the purposes of Tithe Commutation.

Measures for old moduses, &c., might possibly have been made in old customary measures, without Captain Dawson's knowing it.

It is not unusual in the country to judge of the contents of fields by estimation.

In some instances, the error of estimation has been very great. Captain Dawson does not attribute these errors to the existence of different customary acres, but to the mere error of estimation.

Some commutations have been made in Wales. The same acre is used there.

Captain Dawson has seen no instance of woodlands in which different superficial measures were used.

Captain Dawson is not aware that there would be any objection to the use of a 20-yard chain, the acre receiving, at the same time, such an alteration as to make the relation a decimal one.

The present time would be favourable for change.

The surveys made under the Tithe Commutation Act will undoubtedly be adopted in future.

By those Acts, the surveys, when sealed by the Commissioners, may be received as legal evidence. Any maps may (under certain regulations) be used for the commutations, but those only which are sealed can be received as legal evidence.

The first Act required accurate maps; the second Act allowed the use of maps, to the use of which the commuting parties assented, but did not allow them for evidence.

Not one in ten of those now coming into the office are sealed.

By the first Act, the maps could not be received, except the Commissioners approved of them; by the second Act, they may be received (but not necessarily sealed) if the commuting parties agree.

It was at first intended to have an accurate survey of the whole country.

F. 12. Captain DAWSON—*continued*.

Captain Dawson has compared some new surveys with the old ones; has no notes of the difference at hand.

The table of contents attached to the map of a parish or an estate, is frequently found irreconcilable with the areas derived from the lines on the map; the difference is often found to be one-tenth.

The maps for the commutations are usually drawn to a scale of 3 chains to an inch, or 4 chains to an inch.

The maps of only 400 or 500 parishes have yet come in; the whole number will be about 12,000.

F. 13. Mr. GINGELL.

In Somerset, where I reside, the statute perch is acted upon pretty generally (and also in the greater part of the midland counties); and in the adjoining county, Devonshire, the perch is only 15 feet; in Cornwall, it is 18 feet; in Lancashire, 21 feet; in Staffordshire, 24 feet. In square yards, the following are different values of acres:—

The statute acre of England and Wales.	4,840 square yards.
The Scotch acre	6,150 „
The Irish acre	7,840 „
The Cheshire and Staffordshire customary acre	10,240 „
The Lancashire customary acre.	7,840 „

F. 14. Dr. LAMONT.

The Bavarian yard equals 2 feet $10\frac{1}{4}$ inches, Bavarian measure.

The Morgen, Tagwerk, or Tauchert land measure equals 40,000 square feet.

F. 15. Colonel PASLEY.

Proposes to make 1 chain equal to 10 fathoms, or 60 feet (the foot being different from the existing foot), and 1 mile equal to 100 chains; and proposes to subdivide the chain centesimally into links, 10 links equal to 1 fathom. Proposes that the acre be 10 square chains.

F. 16. *Prussian Law Instructions.*

§ 5. Twelve Prussian feet make a Prussian rod, which, for the use of field-measurers, is to be divided only into tenths, hundredths, &c., as far as necessary.

§ 6. A Prussian mile is a length of 2000 such rods.

§ 7. The Berlin ell shall, from this time, contain $25\frac{1}{2}$ Prussian inches.

§ 8. The fathom (faden) for sea affairs, contains 6 Prussian feet.

§ 9. The fathom (lachter) for mining, contains 80 Prussian inches. It is divided into 8 achtels; the achtel into 10 lachter-inches; the lachter-inch into 10 primes; the prime into 10 seconds.

§ 10. The Prussian *Morgen* contains 180 Prussian square rods. No more calculations are to be made by *hufe*, in public transactions.

F. 17. Mr. WALKER.

I have little hesitation in saying that the link and the chain should be got *rid of*; the former is a great plague, for in every map, there are things we never express in links, and hence two measures, two scales, much trouble in converting links into feet, &c. In fact, a *link*, being confined to land measures, gives (through want of habit) an indistinct idea of lengths. If you

F. 17. Mr. WALKER—*continued*.

tell me that a road is 1856 links long, I convert it mentally into feet or yards, before I have a good notion of the length; and, lest habit with me should have led to the opinion, I have asked an experienced land-surveyor, who agrees with me. Rods or perches, in the country, are vile things; in some counties, a rod is 20 feet, and the confusion great when this is squared or cubed.

F. 18. *Westminster Review*.

Proposes a chain of 10 fathoms, or 20 yards, and a mile of 100 chains, or 6000 feet, and an acre of ten square chains.

F. 13*. Rev. R. JONES.

We receive in the first instance certain agreements and awards which contain *estimated* quantities of land. After a time come apportionments, which contain *measured* quantities.

The final instrument of apportionment, which contains a copy of the agreement or award, and consequently contains both admeasurements, is deposited in duplicate. The original remains with us; one copy is sent to the Bishop's register, and another copy to the Minister and Churchwardens to be kept with the parochial muniments.

The measure of land is expressed in acres, roods, and poles.

Of such final instruments of apportionment, we have deposited 2650.

We calculate that we shall have to deposit 9350 more.

We have in our possession 5960 agreements, and 865 awards, containing the estimated quantities—in all, the estimated quantities of 6825 tithe districts; and having finally disposed of and deposited, as I have told you, 2650, there remain 4175 districts in which the actual admeasurement is either in progress, or is completed though not yet deposited.

We find the measured quantities are usually in excess of the estimate to the extent of 15 or 20 per cent.

But our documents only relate to *titheable* lands, that is, more especially the documents which contain measured quantities; and a considerable part of the surface of the country is *tithe free*.

Section 17. The following is a list of the names of the persons who have been granted patents for the discovery of new and useful inventions, and for the improvement of existing ones, in the various arts, manufactures, and mechanical devices, in the State of New York, during the year ending on the 31st day of December, 1880.

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SECTION G.

EXTRACTS RELATING TO THE EXPEDIENCY AND PRACTICABILITY OF ABOLISHING TROY WEIGHT;
WITH NOTES ON ANALOGOUS WEIGHTS IN OTHER COUNTRIES.

G. 1. *Austrian Papers.*

The unit of the Austrian weights is the Vienna pound, equal to 560.012 grammes. It is divided into $\frac{1}{2}$ lb., $\frac{1}{4}$ lb., $\frac{1}{8}$ lb., or into 32 loth; 1 loth is divided into $\frac{1}{2}$ loth, $\frac{1}{4}$ loth, $\frac{1}{8}$ loth, $\frac{1}{16}$ loth; $\frac{1}{4}$ loth is called a quent.

The silver weight is the Vienna mark, equal to 280.644 grammes; 2 marks are equal to 1 mark-pound, or equal to 561.288 grammes.

For money weight (valuations-gewicht), the mark is divided into 65536 richtpfennigstheilen; for silver weight, it is divided into 8, 4, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, and $\frac{1}{16}$ loth; or in increasing series, is used in weights of 2, 4, 8, 10, 20, 50, and 100 marks.

For gold weight, or ducat weight, the unit is the ducat, equal to 3.490598 grammes.

The unit of jewel weight is the karat, equal to 206.0851 milligrammes, multiplied or divided in binary scale.

The medical pound (arzeneigewicht pfund) contains 24 loth of the common weight, or is equal to 420 grammes. It is divided into 12 ounces, the ounce into 8 drachms, the drachm into 3 scruples, and the scruple into 20 grains.

G. 2. Mr. BARRY.

The troy ounce being heavier than the avoirdupois ounce, it is the *interest* of the seller to employ the latter in every case where neither law nor custom entitles the buyer (as in the case of the precious metals and very few other articles) to claim the advantage of the former. A law of limitation would therefore be entirely superfluous; it would be like enacting that the *seller should not give overweight*.

G. 3. Mr. BARRY.

I am not aware of any case in which substances are sold wholesale by avoirdupois weight, and retailed out by troy weight; for the retail sale of drugs is not in point. Troy weight is here never used in simple selling, unless (which rarely happens) the customer specially asks for a certain troy quantity of a drug, as, for instance, one half-ounce "troy;" and then, in fact, he purchases it rated by avoirdupois weight, because the seller (if it be a valuable substance) charges a proportionately higher price. But, although the druggist does not *sell* retail by troy weight, he is bound to employ it in *compounding* physicians' prescriptions, as well as those preparations, the formulæ for which are given in either of the three national pharmacopæiæ.

G. 4. Mr. BARRY.

With regard to the expediency of abolishing troy weights, it is right to mention that its existence occasions no serious inconvenience, I might almost say no inconvenience whatever. There is no inducement in selling, to substitute the troy ounce for the avoirdupois—for it is heavier. The troy ounce, as divided by the medical faculty into 8 parts of 60 grains each, is so much more convenient than the avoirdupois ounce of $437\frac{1}{2}$ grains, that I am confident its retention would be deemed indispensable by practitioners. It is but recently that the London College of Physicians issued a new pharmacopœia, directing troy weight exclusively in all its multifarious operations; and in the present year the Edinburgh College has done the same thing.

G. 5. Mr. BARRY.

There can be no objection to rendering it compulsory to stamp (beside the usual mark of 1 oz., 2 oz., &c.) the word “troy” on all troy weights of one ounce and upwards; in smaller sizes it would be not only practically useless, but inconvenient also.

G. 6. Mr. BATE.

Great inconvenience is felt in the sale of certain articles, as gold, and what is called plate or silver; buyers are at a loss to know whether the price is fixed at so many pounds or ounces troy, or avoirdupois weight, as the ounces and pounds of those weights are at variance with each other; certainly the halving and quartering is in favour of the divisions of the avoirdupois pound as at present constituted. Considering the imperial pound weight as a standard of solemn and unalterable reference, at present consisting of 7000 parts, renders its ounce, or 16th part, $437\cdot5$ parts, which is an awkward fraction of the pound, more especially when we consider that the 16th part of this ounce, called a drachm, is equal to $27\cdot34375$ parts.

G. 7. Mr. BATE.

The proportion of the use of troy to avoirdupois weights, is, in our opinion, as 1 to 2000. The troy weight is used by practical and intelligent men, who can more readily convert their tables of value of this weight to avoirdupois than the less intelligent dealers, with whom the avoirdupois weight is almost an inherent principle or qualification for their respective trades.

G. 8. Mr. BATE.

As a summary of the foregoing, the only alteration relative, or, generally speaking, adequate, to the public advantage and convenience, would be to retain the standard of length, the yard, as it is, the pound avoirdupois the same, and to abolish the use of troy weight altogether, and measures of capacity larger than the gallon.

G. 9. BELFAST INSPECTOR.

The only weights and measures used in this neighbourhood, are those authorized under Act 5 and 6 Wm. IV., cap. 63, avoirdupois.

G. 10. Mr. BOWEN.

The number of sets of weights stamped at the Exchequer, since the Act 5 Geo. IV., to July 5, 1838, is as follows:—

	England.	Wales.	Scotland.	Ireland.	Colonies.	Total.
Troy . . .	73	3	11	3	24	114
Avoirdupois .	598	25	85	71	28	807

G. 10. Mr. BOWEN—*continued*.

The number reverified in the same time, is as follows :—

	England.	Wales.	Scotland.	Ireland.	Colonies.	Total.
Troy . . .	7	..	..	1	..	8
Avoirdupois .	58	3	..	1	..	62

G. 11. Mr. BRIGHT.

With regard to the use of troy weight, it is nearly obsolete, and only used in the wholesale dealing in otto of roses; it used to be employed in the sale of musk, but that has been done away with for many years.

G. 12. Mr. BROWNE.

I may say that, under existing regulations, no difficulty is experienced as to weight.

I should say that the divisions of troy weight are useful, and the whole system of assay by caracts is on the same scale, and by frequent use all calculations are well understood. Certain tables made to facilitate the bringing into standard every variation of quality by assay, would, if alteration be made, be rendered useless.

G. 13. Mr. CHAPMAN.

There is no article in the drug trade sold by any other weight than avoirdupois, with the exception of otto, which, when sold in the original bottles, is calculated by Turkish weight; but when less than a bottle, it is weighed avoirdupois. Ten drachms Turkish is full one ounce troy. Her Majesty's Customs do not calculate on any other weight than avoirdupois; formerly, there were several articles sold by troy; ambergris, musk, and otto, I believe, were the chief, or all indeed, that I can recollect—but the practice has been discontinued many years. Quinine, when first imported, was sold by French weight, which, I believe, is equal to troy, but that is now discontinued.

G. 14. Mr. CHILD.

At all events it is desirable to amalgamate the troy and avoirdupois; the troy being merely used for jewels, gold, silver, and liquids sold by weight, except occasionally by the dishonest tradesman in lieu of the avoirdupois, bearing at present the same legal stamp.

G. 15. Mr. DE GRAVE.

Troy weights are used very little; the proportion between troy and avoirdupois is immense, not one in thousands.

G. 16. Mr. DE GRAVE.

I am of opinion that the troy weight might be done away entirely; the inconvenience to the public of having both troy and avoirdupois is very great; some persons will not, and others cannot, understand the difference between the drachm avoirdupois and the drachm used in medicine. I have often heard it asserted that the troy weight could not be dispensed with, because the pound avoirdupois (7000 grains) could not be divided into halves, quarters, &c., without leaving fractions; but I am of opinion that difficulty might be overcome by altering the grain, still keeping the pound avoirdupois exactly the weight it now is, but making it consist of any number of grains (or whatever else you might be pleased to call them) that could be divided, at all events, without a fraction, as low as the drachm, or $\frac{1}{16}$ part of the ounce.

G. 17. Mr. EDEN.

I understand that in the city of London there are no copies of the troy standards.

G. 18. Mr. GILBERT.

It is clearly a great misfortune that we should have more weights than one, and that the same weight should be divided in more than one manner; and that the *drachm*, for example, in avoirdupois weight, as used in mercantile affairs, weighs 27·34375 grains; in apothecaries' division of the troy pound, 60 grains. A similar inconsistency occurs in the double meanings of ounce and pound. I fear, however, that the evil is entirely without remedy.

G. 19. Mr. GINGELL.

Troy and apothecaries' weight.—It would be exceedingly desirable to get rid of these weights for the "imperial standard," though I admit the difficulty in grappling with this question.

G. 20. GLASGOW COMMITTEE.

The most prominent errors, defects, and omissions in the Weight and Measure Act, 5th Geo. IV. cap. 74, arise from section 4th, where troy weight is fixed as the only unit or imperial standard.

In consequence of this clause, we have *two separate pounds and two separate ounces*; the lesser pound having the larger ounce, and the large pound having the small ounce.

G. 21. GLASGOW COMMITTEE.

In practice, the avoirdupois pound (improperly called the imperial pound) is the weight by which commodities are daily bought and sold; and yet this commercial pound is *not sanctioned as a legal standard*, or, at least, it cannot be regarded as the only standard of weight; it is merely defined, and its parts described as weights for verifying measures of capacity. The apothecary purchases by this pound, and *commonly* sells by the same pound, although he makes up prescriptions according to the troy ounce and its subdivisions. The troy ounce is also used for the precious metals; the troy pound, however, although declared to be the unit, or only standard weight, is never employed in any commercial transaction whatever. It is rarely used by apothecaries, and never by goldsmiths, &c., who only use the troy ounce.

G. 22. GLASGOW COMMITTEE.

The Committee would only further beg leave to recommend, on this part of the subject, what this chamber, on a former occasion, recommended when the question of weights and measures was before Parliament in the year 1813. Thus, the troy scale should be wholly abolished.

They can see no reason why goldsmiths and apothecaries, in the sale of their commodities, should use a different denomination of weights from that employed in the transactions of the other classes of the community; a practice rendered more singular by the circumstance of the apothecaries purchasing by the avoirdupois scale, while they sell by the troy. The College of Physicians should be obliged to publish a pharmacopœia according to the new weights.

G. 23. Mr. HAGGARD.

Mr. Haggard was understood to assent generally to the remarks of Mr. Sharp, as to the difficulty of abolishing troy weight in general, the particular difficulty of altering the value of the grain, and the desirability, if any change were made, of introducing a decimal scale. The following statements were also made by Mr. Haggard:—

The necessity for the allowance of weight in silver bars (mentioned by Mr. Sharp) is

to prevent a loss to the purchasers, arising from the dirt and oxidation on the surface of the bars.

If any changes were made in the value of the weights, Mr. Haggard would wish the names to be changed.

Mr. Haggard would prefer introducing a decimal scale, and abolishing all other scales.

Troy weights are used at the Bank, the Mint, Goldsmith's Hall, and at all Custom-houses.

Troy weights are used in the Colonies, and in India, for precious metals.

G. 24. MR. HAGGARD.

The exclusion of the troy weight would not benefit the mass of persons who use the avoirdupois one iota; there is not a butcher, baker, or cheesemonger, in the kingdom, who cares one farthing about the use of the troy weight, for they never have cause for reference to it; but it would cause utter confusion in all calculations of exchange; in assays, it would alter the report of all gold and silver, and would render useless a great number of valuable and correctly constructed tables for bringing various weights and qualities into English standard.

G. 25. MR. HAGGARD.

There is not a family in the United Kingdom, above the pretension of an iron spoon, who have not purchased silver plate at so much the ounce troy, without any expression of ignorance on the point, or any inconvenience arising from the use of that weight. There is not a pawnbroker who does not periodically send to the auction-rooms for sale plate to be sold at per ounce troy, and purchasers of which may include the rich and the poor, the enlightened and the ignorant; yet do these ever find inconvenience, or complain of a want of knowledge on the subject?

There is not a merchant in London, Liverpool, and other outports, who does not occasionally receive bullion, which is sold at a given price the troy ounce; and I know of no inconvenience to them arising from it. There are thousands of foreign merchants trading with England, who compare their weights of the precious metals with the troy weight. I am quite sure this (by some despised) weight is much more in use than the generality of persons suppose, and I think there is a want of justice on the part of those who say the English people are without knowledge on the existence of the troy weight, or its particular uses.

G. 26. DR. HAVILAND.

With regard to your inquiry respecting the contemplated alterations in the weights used by the apothecary, there can be no doubt that to establish a uniformity would in itself be decidedly advantageous.

An objection to change of weights may be supposed to apply to the medical practitioner or prescriber. It does not appear to me, however, that any inconvenience would arise from this source. We never prescribe solids by the pound; and in the ounce and its subdivisions, the ratio of troy to avoirdupois is 11 : 10, a difference easily remembered, and which, if overlooked, would never be of any consequence, especially as the change would be a reduction and not an increase in the value of the measures. Where the medicines are very active, the dose employed is proportionately small, and an error, if committed, would not be felt. I am quite satisfied that, in estimating the propriety of the alteration, all consideration of the nature of the articles to be measured may be safely laid aside. This opinion is in conformity with the recent proceedings of the College of Physicians, who have to a much greater extent altered the liquid measure, which is in more frequent use by physicians than the weight, and is more commonly applied to the most active and delicate medicines, as the tinctures, and the metallic solutions of arsenic, corrosive sublimate, &c.

G. 27. Dr. LAMONT.

As apothecaries' weight, the old apothecaries' weight of the town of Nuremberg was adopted [in Bavaria].

G. 28. Mr. MAY.

With regard to troy weight, as connected with drugs and pharmacy on the large scale, I have no hesitation in saying that the sooner it is abolished the better.

There are some, although but very few, drugs sold wholesale by troy weight, whilst the pharmacopæias adopt it entirely, thus rendering it necessary to make a calculation for each process in order to bring troy into avoirdupois. I shall be told that the ready way to obviate this is to use troy weights, and I know they are usually kept by druggists; but the reduction even then has to be made in computing the cost of each compound, and in practice this is best done at first, and use avoirdupois weights throughout; simple as the calculation is, it involves a chance of error without a particle of advantage to counterbalance it.

G. 29. *Prussian Law Instructions.*

§ 26. Jewels in future are to be weighed by carats and their subdivisions into halves, quarters, &c. 160 such carats shall be equal to 9 Prussian quentchen.

G. 30. *Prussian Law Instructions.*

§ 18. The weight of a Prussian cubic foot of distilled water in vacuum, at a temperature of 15° of Reaumur's mercurial thermometer, is to be divided into 66 equal parts. One such part is a Prussian pound.

§ 19. The half of this pound agrees exactly with the Cologne mark, hitherto commonly used for the Prussian money; and shall for the future be used under the denomination of the Prussian mark, for the weighing of money and of gold and silver.

§ 20. The double division of the *mark*, for gold into 24 carats, for silver into 16 *lothe*, shall no longer be officially used; but the *mark* for all the precious metals shall be divided only into 288 grains.

§ 21. The Prussian pound (§ 18) shall also serve as a merchant's weight (*kramergewicht*), and for this purpose shall be divided into 32 *loth*, and the *loth* into 4 *quentchen*.

§ 24. The peculiar butchers' weights shall be no more used. The butchers in future shall use the merchant's weight (*kramergewicht*).

§ 25. The apothecaries' weight retains its customary divisions. Thus the apothecaries' pound has 12 ounces, the ounce 8 drachms, the drachm 3 scruples, the scruple 20 grains.

But the weight of these divisions shall be so determined that the apothecaries' pound may contain 24 Prussian *lothe*, the ounce 2 such *lothe*, the drachm 1 Prussian quentchen.

G. 31. Mr. REEVES.

The use of troy weight, being confined to dealers in bullion, jewels, &c., is of course very limited. As far as the Inspectors' knowledge of the extent of the use of troy, from having troy weights under their examination, the proportion to avoirdupois is not 1 in 20,000; but from inquiry, it may be considered to bear a much greater proportion to the whole number of weights in use.

G. 32. Mr. REYNOLDS.

Troy weight is used very little, being confined to very few trades, and ought to be abolished, as the dishonest tradesman can have troy weights stamped, and use them on his counter as avoirdupois.

G. 33. Dr. ROGET.

I see no advantage that can arise from the retention of the troy *pound*, which is I believe employed only in pharmacy, and in the estimation of the weights of the precious metals; but the troy *grain* has been for so long a time and so universally employed as the unit for smaller weights, not only in medicine but also in the physical sciences, that it appears to me highly inexpedient, and indeed scarcely practicable, to abolish this unit, or to substitute for it any other of nearly equal magnitude. In the practice of medicine more especially, any deviation from the established weights which have the troy grain for unit, would, in my opinion, be productive of enormous evil from the extreme difficulty which would practically be experienced in inducing persons to adopt new modes of calculating quantities and proportions, and from the consequent danger of mistakes being made both in the prescription and in the pharmaceutical preparation of medicines. The troy pound, on the other hand, has no advantage that I know attending it, than this, namely, that the number of grains it contains (5760) has a multitude of divisors, whereas the number of grains in the avoirdupois pound (7000) has much fewer aliquot parts. But in all other respects, it appears to me to be superfluous, and as far as relates to medicine, might be abolished without inconvenience. The troy *pennyweight* being never used in medicine need not be retained. But the *scruple*, the *drachm*, and the *ounce*, must still remain as the denominations of 20, 60, and 480 grains respectively. I can see scarcely any objection to reference being always made to the grain, as being the $\frac{1}{480}$ part of the avoirdupois pound. The principal difficulty would be in the ounce, which differs considerably from the avoirdupois ounce of 437.5 grains. This latter ounce it would probably be best to abolish.

G. 34. Dr. ROGET.

Dr. Roget considers that an alteration of the troy weights in the proportion of 11 to 10, would cause great inconvenience; the calculation of doses would be much embarrassed.

If the doses of medicines administered, were altered in the proportion of 11 to 10, inconvenience might result to the patient in the exhibition, for instance, of opium, arsenic, and other active medicines.

Dr. Roget considers it necessary to retain the present value of the grain. The ounce weight might be altered or abolished much more conveniently than the grain.

The scale of sub-divisions of the ounce could not be altered without great inconvenience. It is completely rooted in the habits of physicians, for the mental calculations they must continually have recourse to in extempore prescriptions.

The fluid ounce of physicians, though referred for its definition to a weight of water, is not in practice regarded as a weight, but as a measure of capacity.

The weight to which the definition of the fluid ounce refers, is the avoirdupois ounce.

The fluid ounce has been changed in the last edition of the pharmacopæia in the proportion of 25 to 24. This change was treated by physicians as immaterial.

The troy ounce hardly ever occurs in prescriptions to patients, but it is used in the preparation of medicine in large quantities. The inconvenience of change in the value of the weights with reference to such uses as this, would be much less than with reference to their application in prescriptions.

If, however, the values of all the weights were altered, physicians in general would probably continue to prescribe according to the forms they had been accustomed to, and would not make the necessary allowance for these alterations. Dr. Roget believes that prescriptions are made up by foreign apothecaries without alteration for the possible difference in the unit of weight.

The ounce may perhaps be given up; ounces do occur in the pharmacopæia, perhaps also pounds.

G. 35. Dr. ROGET.

The French pound (*livre*) of the French pharmacopœia, is considered as being equal to 500 grammes. It is sub-divided into 16 ounces; each ounce into 8 gros; each gros into 3 scruples; and each scruple into 24 grains: so that the livre consists of 9216 ($=24 \times 3 \times 8 \times 16$) grains, one of the latter being equal to 0.0542535 grammes, which (taking the gramme at 15.444 English grains) is $=0.816211554$ English grains. From these data, I have computed the English grain to be $=1.225$ French grains; the two being nearly in the proportion of 9 to 11.

In the formulæ given for the composition of medicines, the weights of the ingredients are specified both in the foregoing denominations (or sub-divisions of the *livre*), and also in grammes; but as the exact correspondence of these two systems of weights would, in almost every case, involve fractional parts, approximate values only are given; for which purpose the ounce is assumed as being equivalent to 32, instead of 31.25 grammes, which would be its correct value, and when considered as the $\frac{1}{16}$ part of 500 grammes. In like manner the gros is considered as equivalent to 4 grammes, instead of 3.90625.

In the pharmacopœia Batavia, the medical pound is stated as being equal in weight to $\frac{3}{4}$ of the tricassius pound (*libra tricasina*). Its sub-divisions are into 12 ounces; the ounce into 8 drachms; the drachm into 3 scruples; and the scruple into 20 grains, as in the English system of apothecaries' weight. Reference is made to the gramme as being a recognized standard weight, and it is stated that 6 grains weigh exactly 0.385 grammes; from which proportion I have computed, that (again taking the gramme as $=15.444$ grains English) the English grain is to the Dutch in the ratio of 109 to 110, which is very near that of equality. It is, however, stated in the same page of this pharmacopœia, that 18 grains are $=1$ gramme, a ratio which is evidently very different from the one before given, namely, that derived from 6 grains being $=0.385$ grammes. I can account for this discrepancy only on the supposition that the former ratio was adopted for the convenience of having to deal with whole numbers.

In the pharmacopœias of Austria, Prussia, Sweden, and Denmark, the sub-divisions of the pound into ounces, drachms, scruples, and grains, are exactly the same as the British; but no reference is made to any recognized standard by which they may be compared, either directly or indirectly, with the latter. It would appear, indeed, that there is considerable diversity in the value of weights of similar denominations in different countries. Dr. Young has given in his Lectures (Vol. ii., p. 164) a table on the authority of Vega, of the apothecaries' grains in different countries in Europe; the differences are considerable, and must materially affect the composition of medicines made up from the same formulæ in different countries.

G. 36. Russian Papers.

La livre d'apothecaire sera composée de 8.064 dolys on de $\frac{7}{8}$ de la livre Russe.

G. 37. Mr. SHARP.

I think it would be very difficult and very disadvantageous entirely to abolish the troy weight, particularly the troy grain. In the uncertainty of any original standard, this grain may be called the elementary weight or unit, the basis of all the different weights now in use in England; for though by the Act 5th Geo. IV., cap. 74, the troy pound weight made in the year 1758, is declared to be the original and genuine standard weight, and to be 5760 grains, the Act continues that 7000 such grains shall be a pound avoirdupois, &c., &c., so that this grain is really the basis of the higher weights of different denominations. By the troy grain all our coins are weighed, and their proportions of pure metal and alloy given. We use the troy grain to compare all foreign weights, especially in coins and bullion, with our own.

Our Assayers' Reports of gold and silver, and all our tables and calculations, are made with reference to troy weight. (The Assayers' weights are troy weights in miniature, their pound being about 12 grains.)

G. 37. Mr. SHARP—*continued.*

I am therefore of opinion, that whatever other changes may be thought beneficial, the troy grain should be retained as the basis. I do not mean a piece weighing one grain troy, but that the standard should be of a certain number of grains troy, and that the troy grain should be referred to in all weights and their subdivisions.

It may perhaps be in contemplation to make avoirdupois the universal weight to the exclusion of others; but it may be doubted if, with respect to the precious metals, this is even possible. Much the greater part of the bullion and foreign specie which comes to this country, is on account of private individuals, many of them foreign merchants, chiefly Spanish: they are accustomed to the troy weight, and unless some advantage could be shewn, they would not incur the trouble and confusion of altering their whole system of calculation and accounts; and as the precious metals pay no duty, and have not to pass through the Custom-house, or any public office, merchants could not easily be prevented continuing that system which they found most easy and convenient for themselves. It is not merely the actual weight as it passes through the scale, but for every ingot of gold or silver, or mixed metal, there is a calculation necessary to determine its standard weight by which it is bought and sold, and not by the gross weight; so that a bar of gold weighing 180 ozs., may be sold as 197 ozs., 7 dwts., 17 grains.

Should any change be introduced by authority in the Bullion-office, Bank of England, unless some advantage could be shewn in the adoption of the new scale, the only effect would be to induce parties interested, to resort to other channels for the purchase of bullion, for which there are abundant facilities. The various Acts (in a great measure ineffectual) which have been passed on the subject, prove the difficulty of making alterations.

If any change holds out sufficient advantage to insure its adoption, it is to a decimal scale rising from the troy grain; the extreme facility of calculation, and the much greater security against errors, render it most desirable.

We use troy weights from 60 lbs. to 1 grain, including all the usual sub-divisions, and diamond weights, in carats, from 1 carat to 1000 carats. The carat is divided into $\frac{1}{2}$, $\frac{1}{4}$, or one grain, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$.

Messrs. Bastick and Driver, scale-makers, who regulate our scales and weights, have authenticated and stamped copies of the standard deposited at Founder's Hall, and our scales and weights are regulated once a week, or oftener if required, by these copies. Most of our weights are stamped at Founder's Hall. No disputes ever occur concerning our weights. We are in constant comparison by receiving and delivering weighed specie and bullion with the Bullion-office, Bank of England, and frequently with the Royal Mint.

We tolerate no inaccuracy: but in large weights of silver do not break ten pennyweights, nor in gold, six grains.

We have constant opportunities and occasion to compare the weights we use with foreign weight; from these comparisons we have made the tables we most frequently require, and our authority in some cases is Dr. Kelly's Cambist (2nd Edition), which we find very accurate.

G. 38. Mr. SHARP.

The allowance of 10 pennyweights (mentioned by Mr. Sharp) applies to bars of silver of 50 lbs. to 80 lbs.—the allowance of six grains to ingots of gold 15 lbs. to 20 lbs.

The number of persons who use troy weight is considerable—every goldsmith, or silversmith, uses troy weights.

From half to two-thirds of the merchants in London are occasionally concerned in transactions of bullion or specie, the accounts of which, in London, are always rendered in troy weight.

Mr. Sharp thinks that many persons would continue to use the troy weight—there appears to be no authority which can enforce the use of another weight.

G. 38. Mr. SHARP—*continued.*

If by law, it were made necessary to express in contracts the weights of the precious metals by any new system—the two systems (the old and the new) would be used together—the contracts would probably run thus:—

January 1839,

Sold, for A. B., about 950 grains (or as it may be) imperial weight of bar silver, being equal to 10,872 oz. old troy weight, at 5s. per oz. troy, &c. &c.

J. G. and G. A. Sharp, Brokers.

Mr. Sharp observes, that the weight stated in contracts is almost always inadequate, as bullion is mostly sold before it is weighed.

Bullion is invoiced to London generally in the weights of the country from which it comes; most frequently in Spanish *marks* for silver, and *castellanos*, or Spanish *ounces*, for gold; or from Portugal in *marks* and *oitavas*; or from China, whence there have been occasionally very large importations of silver, in *taels*.

All bullion, however, which is sent to this country, is always weighed here, and is valued according to its weight here.

The accurate weighing by ounces and grains, &c., is therefore made in this country, and the power of adopting or rejecting troy weight, so far as depends upon its use for bullion, does really reside in this country.

G. 39. Mr. SHARP.

Mr. Sharp would personally prefer to have no change whatever in the system of weights, as regards bullion. But whatever change were made, Mr. Sharp thinks it necessary that the grain should not be altered.

Mr. Sharp never knew any inconvenience to arise from the use of the two systems of weight (*avoirdupois* and *troy*); has often been interested in large sales of plate by public auction, but never knew a buyer misunderstand the weight he was buying by, which is always the ounce *troy*.

Troy weights are kept at the Custom-house, and are used for weighing coral, plate, pearls, and many other articles, for the duties, and also at the West India Docks, and all other docks or places of landing goods for the same purpose.

Pearls are either sold by the piece according to their weight, or by the ounce *troy*, which is divided into 600 grains; this is the custom with all dealers in pearls. Single pearls of value are sometimes weighed by diamond grains.

G. 40. Mr. SHARP.

I see no objection or difficulty in limiting by law the use of *troy* weights to certain substances, including gold, silver, platina, coral—manufactured and rough, amethysts, topazes, crystal, and other stones at present sold by *troy* weight, as well as some drugs in wholesale.

It would produce no inconvenience, that I am aware of, to forbid the use of *avoirdupois* weight for these substances, *troy* weights being exclusively used for them at present; still, if any persons chose to sell their gold or their coral beads by *avoirdupois* weight, I do not see how any law could be enforced to prevent them.

Supposing that *troy* weights should be retained with their names, pounds, ounces, penny-weights and grains, I think it would be of the greatest advantage that the names of other weights should be changed; that is, the terms pounds, ounces, &c., should only be applicable to *troy* weights. It would also be most beneficial to enforce by law, that all *troy* weights should be marked with the word **TROY**, excepting of course the very small weights where there is not room for such mark; indeed, this is almost universally the practice at present.

G. 41. Mr. WADE.

As relates to troy weight, I have not had one set brought me to stamp since the passing of the Act; I believe there are very few in use, and they are generally stamped at Founder's Hall.

G. 42. Messrs. WARNER.

We think there can be no necessity for two sorts of weights, *viz.*, troy and avoirdupois. We would recommend the discontinuance of the troy, and that the avoirdupois pound should henceforth be considered the standard of England, being more generally used and understood best.

G. 43. Messrs. WARNER.

The use of troy weight is in no proportion to that of avoirdupois, perhaps not more than 1 troy weight to 5000 avoirdupois may be in circulation at this time throughout England.

G. 44. *Westminster Review*.

Remarks that in former enactments the uses of troy weight have been strictly limited, but that at present troy weight has equal authority with avoirdupois. [This applies to the year 1832.]

G. 5*. Mr. BARRY.

The avoirdupois drachm (the $\frac{1}{8}$ of the ounce) is not used in the business in which I am engaged; nor am I aware that it is used in any other business.

We usually describe weights smaller than the avoirdupois ounce, by the number of grains (437½ to the ounce av.); or by the scruple (ap.) of 20 grains, or by the drachm (troy or apoth.) of 60 grains; and though this may appear complex, we do not find any practical inconvenience; the transactions in which it is resorted to, being few, and chiefly with medical men, who make up their compounds by troy weight.

G. 40*. Mr. SHARP.

Begging you to excuse my so earnestly and repeatedly pleading for the *troy* grain, I proceed to answer your questions.

1st. "Would it be advantageous, as regards the trade in bullion, that the Standard Offices should be provided with standards of 10 grains, 100 grains, &c., in decimal scale, and to what extent?"

Presuming that you here refer to the *troy* grain, and contemplate relinquishing the *ounces*, and *pounds*, I think a decimal standard of 10 grains, 100 grains, &c., to the extent of about 300,000 grains, would be advantageous.

By whatever denominations the new standard weights might be called, they should assimilate as nearly as possible with the present ounce and pound troy. Without presuming to suggest this scale in particular, something like the following might be adopted.

In single grains,—1 grain to 19 grains; the next weight of higher denomination, might be 20 grains, in lieu of the present pennyweight. The next of 500 grains troy, being near the present ounce troy; and then to 5000 grains, as near the pound troy, which might be the highest denomination of weight; and 50 of these, or a weight of 250,000 grains, might be the largest standard weight.

G. 40*. Mr. SHARP—*continued.*

2nd. "Is it likely that such a scale of weights would be extensively used by dealers in bullion?"

I cannot say how it might work, but I think that if any such scale were established by authority, at the Bank of England, the Royal Mint, and other public offices, the less it differed from the present system, the more readily and extensively would it be used by dealers in bullion.

3rd. "Would it be advantageous that the standard offices should be provided with standards of 10 troy ounces, 100 troy ounces, 1000, &c.?"

4th. "The first and third query apply to two distinct decimal scales; is it likely that both these would be introduced in practice, or that one would be introduced to the exclusion of the other?"

Supposing the Standard Offices to be provided with standards of 10 grains troy, 100 grains, 1000 grains, &c., in some such proportion as I have mentioned before, I do not think it would be advantageous for them to be provided also, with standards of troy ounces of 480 grains, in 10 oz., 100 oz., 1000 oz., &c.; the two scales could not work together.

But if you mean by this question to drop the *pound troy*, and to adopt the present ounces in a decimal scale, then, I think, that this being the least alteration, it would be the most likely to come into general use.

Though you state that the first and third query apply to two different scales, I have presumed that you refer in both to the *troy grain*; should that be altered, I fear the greatest difficulty and inconvenience; for to divide the *pound troy* into 5000, or any new number of grains, would be productive of as much confusion as dividing the hour into 70 minutes.

G. 40**. Mr. SHARP.

Sales of bullion *are* effected in general by the ounce, and smaller denominations—common troy weights are *not* adapted to this—the weights in common use are, 1 oz., 12 oz., 2 lbs. or 24 oz., 3 lbs. or 36 oz., 5 lbs., 10 lbs., 15 lbs., 20 lbs., &c., &c.

The instance you mention 83 lbs. 4 oz., or 1000 oz., is the single exception which we have made for our own convenience, as dollars and foreign silver coin are weighed up for sale in bags of 1000 oz. each; but we never use, nor have occasion for weights of 100 oz., 200 oz., 300 oz. &c.

The troy pound *is* of some use; all our tables and calculations of the standard quality of gold and silver are adapted to it; and in our accounts the weights are given in pounds, and the totals turned into ounces, and cast out at the prices; for example, 3000 Dollars:—

1000 Dollars wg. lbs. 72 3 10					instead of 1000 Dollars wg. oz. 867 10
„ 72 4 0					868 0
„ 71 11 10					863 10
			oz.		
lbs. 216 7 0 =	2599	at	per oz.	oz. 2529 0	at per oz.

In an account of two or three hundred thousand dollars, or as many bars of silver, this would make considerable difference in the labour, particularly in bars of silver, as the weights run very irregular.

The fact, that though both coin and bars are dealt in by the ounce, the weights are almost universally *called*, and *put down* in pounds, proves, I think, the convenience of the practice—the pound, or some other weight of higher denomination than the ounce, is necessary.

SECTION H.

EXTRACTS RELATING TO THE EXPEDIENCY AND PRACTICABILITY OF INTRODUCING DECIMAL SCALE; WITH SOME INSTANCES FROM OTHER COUNTRIES.

H. 1. *Austrian Papers.*

The weights used in increasing series above 1 lb., are 2, 3, 4, 5, 10, 25, 50 lbs. 1 centner = 100 lbs. No denominations for large weights are used in common business, except pounds and centners.

H. 2. Mr. BATE.

Numerically speaking, nothing can be more simple or effective in its operation with the more intelligent class of the community than decimal division; but it would require a careful and lengthened legislative interference to induce the commonalty to conform to units of 10 or 100, instead of the present half or quarter of a pound; the same as to ounces or to the cwt. Ladies would still insist upon buying silks or such articles by the yard, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, or $\frac{1}{16}$.

H. 3. Mr. BIDDELL.

I am of opinion that our measures of length, and measures of capacity, must be adapted to each other decimally, and both have their foundation in the *present statute chain*. By that measure, from the time of Edward VI. the surface of the kingdom has been calculated, and every plot of ground measured and recorded individually and collectively in some writing or other. By that chain are all the expensive tithe surveys going on throughout the kingdom: and that chain remaining as the standard for new measures and expressions, the present measures of inches, feet, and yards, as they might wear out of people's heads, would be easily made to correspond with lengths of new measure, the first crude idea of which that occurs to me is to proceed backwards from the chain of 100 links, to a fathom of 10 links; a new yard or new name 5 links; link; some new name $\frac{1}{10}$ of a link; mite $\frac{1}{100}$ of a link. There would require a division between the link and the fathom, consisting of 5 links, which had better have a new name of one syllable, rather than be called the new yard; and another division between the mite and link (a new name), and not new inch.

H. 4. Mr. BIDDELL.

My opinion is, that no change could take place, equal in practical utility to future generations, to divisions of measures purely decimal. Its utility would be greatest to the great and uneducated mass of the people; who would, when once the measures began, multiply and divide almost without learning any regular rules of arithmetic.

H. 5. Mr. BLACKBURN.

If the legislature are anxious to simplify our standard, I consider the best plan to make our cwt. = 100 lbs.; making the divisions the same as our present troy-weights, 50 lbs., 30 lbs.,

H. 5. Mr. BLACKBURN—*continued.*

20 lbs., 10 lbs., 5 lbs., 3 lbs., 2 lbs., and 1 lb., but I should fear such a sweeping affair as this would necessarily give great cause of complaint.

H. 6. Mr. CHILD.

As to the 100 lbs. weight, if used, it would be the means of introducing the decimal system, an admirable and scientific arrangement of money, weight, and measure.

H. 7. Mr. CUBITT.

My opinion is, that for popular use, the division of the inch into eighths is much more convenient than it would be in tenths, although there is no doubt that calculation would be much facilitated if the foot could be made to consist of 10 inches and the inch of 10 parts, that is, if the foot were decimally divided. In fact, we (the civil engineers) invariably, I believe, use the decimal division of the foot on our station staves for levelling, in order to facilitate the casting out, but in preparing plans for Parliamentary use, we are obliged to turn all the decimals into inches again, because there is a "standing order," which says the levels shall be given in "feet and inches," and therefore it has been held that the law is not satisfied with feet and decimals of a foot; and on this grave point, I have known Bills thrown out of Parliament, so difficult is it to reconcile the spirit and the letter of the law. Now if, instead of feet and inches, the Standing Order Committee would make it "feet and inches or decimals of a foot," it would be an improvement.

The decimally divided foot on the edge of the common foot rules is very frequently used by myself for instantaneously converting the portions in inches, &c. less than a foot into decimals of a foot, and also for other purposes, but I doubt whether it be commonly or generally used.

In ascertaining superficial or solid content, decimal operations are, I believe, generally resorted to, and for which the decimal division above alluded to is applicable; but I do not think that because multiplication is best done decimally, that is a sufficient reason for altering the accustomed mode of division on measuring rules, whilst a means is already provided on all those rules for throwing the terminal inches and parts into decimals of a foot.

H. 8. Mr. CUBITT.

Taking the pound avoirdupois as the unit, or the $\frac{1}{1000}$ part of a cube foot of water, I think much convenience and little danger would result from the adoption of 100 lbs. for the hundred-weight, and 2000 lbs. for the ton; and I have no doubt that this was the original intention, but altered by the ancient custom of giving 21 to the score, and 13 to the dozen, and 6 score to the hundred, &c. &c.

H. 9. Mr. DE GRAVE.

I consider the division of the pound into halves, quarters, &c. better than any other, generally speaking. Decimals may be best for scientific experiments, but very inconvenient for all practical purposes. I also consider the present division of measures better than any that could be devised.

H. 10. Mr. DE GRAVE.

Altering the 112 lbs. to 100 lbs., would on many accounts be a very great improvement. I would suggest the following scale, 100 lbs., 50 lbs., 25 lbs., 10 lbs., 5 lbs., 4 lbs., 3 lbs., 2 lbs., 1 lb.

H. 11. Mr. EXLEY.

Although the present sub-divisions may be good and work well generally, yet it is very desirable for ease, expedition, uniformity, national convenience, and prevention of frauds, to have

H. 11. Mr. EXLEY—*continued*.

some one universal mode of sub-division, and perhaps none could be better than the denary or decimal division.

H. 12. Mr. EXLEY.

The sub-divisions, under proper restrictions, and having particular regard to uniformity, may be similar to those of the new French measures.

In my opinion, the sub-divisions of length should in all cases be decimal, proceeding from the unit both ways; and the same may be applied to area and capacity.

H. 13. Mr. GILBERT.

Admirable as is the decimal division for all matters of calculation, the binary is the one suited to the common affairs of life. Witness the yard, the half-yard, the quarter-yard, the nail; and even at the Stock Exchange the prices of stock are counted by $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{8}$, &c.

H. 14. GLASGOW COMMITTEE.

If the denomination "*stone*" is to be again introduced, the number 20, or the "*score*" of pounds (a weight well known in Lancashire,) at once presents itself as the proper quantity for simplifying and facilitating calculations; and, if in keeping accounts, the denominations hundred-weight and ton, are to be retained, five of such "*scores*" of pounds, or 100 lbs., ought to be sanctioned as the correct hundred-weight; and 20 such hundreds, called "*two thousand-weight*," or 2000 lbs., ought to be constituted the ton; in other words, the ancient and original hundred-weight and ton ought to be restored. Our weights would then stand according to the following schedule:—

lbs.	Score.	Cwt.	Ton, or 2,000 weight.
20	1		
100	5	1	
2000	100	20	1

The adopting 100 lbs. instead of 112 lbs., as the hundred-weight, cannot be viewed as an innovation, for this would, in fact, be merely adopting pounds weight instead of hundred-weights. Besides, an Act of the 43rd of Geo. III. fixes the nett 100 lbs., as the standard hundred-weight for tobacco, indigo, pepper, gums, and above twenty other articles of commerce. In the United States of America, particularly in Virginia, the Carolinas, and Georgia, sales are made by the quintal or kintal of 100 pounds avoirdupois. This ought to be declared and enacted to be the imperial standard hundred-weight for the United Kingdom of Great Britain and Ireland, and for its colonies and dependencies. Such an enactment would give great facilities in commerce; it would introduce the easiest methods of computation, so that arithmetical results would be accurately obtained by a glance of the eye, or by mental calculation. There is reason to believe that this standard hundred-weight will be adopted in the whole of the United States of America; and (as the Parliamentary Commissioners on weights express themselves,) may "tend in no small degree to facilitate commercial intercourse, and by so doing, to consolidate a lasting friendship between the two great nations of the world, most assimilated by their language, their laws, religion, customs, and manners."

H. 15. Mr. HAGGARD.

Feeling the confidence of a practical person, I am induced to offer to the notice of the Committee on Weights and Measures (which it is hoped will not be thought presumptuous,) a proposition to the effect, that all the present weights now in use should merge into a new

H. 15. Mr. HAGGARD—*continued*.

weight, such as shewn in table No. 1, which is based upon the present grain, and decimally arranged. (Specimens of tables accompany this communication.)

H. 16. Mr. HAGGARD.

In conclusion, I beg to state my decided opinion that no alteration should be made of the present weights, avoirdupois, troy, or apothecaries', preferring any one to the exclusion of the others, (which must inflict upon those who have been accustomed to use the discarded weight, a labour and inconvenience without a corresponding advantage.) And that any change shall have reference to a perfect and uniform system, the decimal, one of such manifest convenience as to insure its ready and general adoption.

H. 17. Signor LANA.

The present Government of Piedmont has had no difficulty in regard to the metrical measures, &c., which had been introduced by the former Government.

H. 18. Professor MILLER.

Good balances are now provided with a decimal scale of weights, from 0·001 grain to 1000 grains; might not a name be given to the 1000 grains or 10,000 grains, which would distinguish it from the weight of any other country?

H. 19. Count MOLÉ.

La loi du 4^{me} Juillet 1837, remettant en vigueur, à partir du 1^{er} Janvier 1840, le système metrique décimal, M. le Ministre des Finances a chargé une commission speciale de rechercher et indiquer les moyens les plus propres à en assurer l'entire exécution.

H. 20. Col. PASLEY.

Proposes the following scale:—

10 Parts = 1 Digit.	:	10 Digits = 1 Foot.
10 Links = 1 Fathom.	:	10 Fathoms = 1 Chain.
100 Chains = 1 Mile.	:	60 Miles = 1 Degree.

H. 21. Col. PASLEY.

Proposes—

1000 [new] square Fathoms	=	1 Acre.
1000 Acres	=	1 square Mile.

H. 22. *Prussian Law Instructions*.

§ 22. 110 pounds are 1 Prussian centner.

H. 23. M. QUETELET.

La marche suivie par le Gouvernement precedent [en Belgique] tendait à étendre de plus en plus les divisions decimales: sous le nom d'aune, on avoit admis le mètre pour mesure légale; et l'on avoit adopté aussi le kilogramme pour les pesées; mais tous les noms Francais de litre, are, hectare, &c., avaient été changés, quoique dans le fait les mesures eussent été conservées. Pour les monnaies seulement on avoit pris le florin qui valait environ 2·116 francs, et cette unité se soudivisait en parties decimales.

Lors de l'établissement du Gouvernement actuel, on conserva toutes les mesures decimales mais en rétablissant les noms Francais: et au florin des Pays-bas on substitua le franc pour unité monétaire; ce système est très en vigueur: et l'on peut dire que le système decimale est actuellement d'un usage plus général en Belgique qu'en France même.

H. 24. Mr. REYNOLDS.

With respect to the 100 lbs. weight, there is no necessity for it under the present system; but my impression is, that the hundred-weight should be but 100 lbs., and substitute the decimal system, which would correspond with other countries.

H. 25. Mr. SHARP.

A decimal system, proceeding upwards from the troy grain, might more easily be introduced than any other change among persons engaged in bullion transactions.

The decimal system, when adopted by persons dealing in bullion, would soon find its way to general use among goldsmiths and silversmiths, &c. The number of goldsmiths and silversmiths is much greater than that of merchants and bullion brokers.

There are also refiners who prepare gold and silver for the use of the goldsmiths and silversmiths.

H. 26. Mr. THOMSON.

I have no hopes that our Government will ever entertain so bold and useful a project as that of adopting a decimal system of weights and measures, and I think nothing short of this would justify a disturbance of the present system.

H. 27. Mr. WALKER.

There are, I presume, good reasons for going by tens, which divide by 2 and 5 only, in preference to twelves, which divide by 6, 4, 3, 2 (the adaptation of decimals in this and other countries is one of them); and supposing these reasons to exist, I should vote for decimals in all cases. We are getting into it by degrees. Our levelling staff used to be divided into feet, inches, and tenths—now feet and decimals. Great advantage would be derived from having the unit such as to be generally applicable:—suppose a foot; an inch $\frac{1}{10}$ of a foot; a chain 100 feet; a rod 20 feet (10 would be better put for custom); an acre 10 square chains, or 100,000 feet. The *acre* would cause less disturbance, from acres being, like perches, various.

H. 28. Mr. WALKER.

Rod is a good name, and 10 feet a good length; it is the fact that the piece of wood most common amongst builders for measuring, as being handy to carry about and to arrange, is ten feet long, although 16 ft. 6 in. is the statute rod. Inch also good; but if you divide a foot into ten parts, to use the word inch will confuse for a long time; to be sure you may say decimal inch or dec-inch, or better still, d-inch, and then *dinch*. The yard I propose leaving out, and making the foot the standard, unless you take the French metre.

An ounce of water will be a d-inch (according to my notions), which is worth something.

H. 29. Messrs. WARNER.

We consider the 100 lb. more desirable than the 112 lb., provided the smaller weights were to correspond, *viz.*, a set containing the following, 100 lb., 50 lb., 25 lb., 10 lb., 5 lb., 4 lb., 3 lb., 2 lb., 1 lb., would be much more convenient for calculation, and more readily comprehended by foreigners.

H. 30. *Westminster Review*.

In order to give practical facility in the mensuration both of surface and of solidity, though we cannot go the length of recommending, with Professor Playfair, that as the foundation of a system exclusively decimal, the linear foot should be sub-divided into 10 digits; yet we cannot help wishing that such a sub-division had been recognized. The recognition of digits would be by no means the suppression of inches. The foot rule might be sub-divided into inches on one side, and into digits on the other.

H. 31. *Westminster Review.*

Recommends the following scale:—

10 Fathoms	= 1 Chain.
10 Chains	= 1 Furlong.
10 Furlongs	= 1000 Fathoms = 1 Mile.
10 square Chains	= 1 Acre.
1000 Acres	= 1 square Mile.

The length of a geographical degree expressed in these measures, would be 60 miles and 824 fathoms.

H. 32. *Westminster Review.*

Proposes to reject the hundred-weight of 112 lbs., and ton of 2240 lbs., and to use instead these weights, 1 lb., 2 lb., 2 lb., 5 lb., 10 lb., 10 lb., 20 lb., 50 lb.; 20 lb. to be called the score-pound: and remarks, "But we fear no means for introducing so desirable an improvement would be sure to succeed, if not accompanied by some arrangement respecting weights somewhat resembling those energetic measures which introduced the present silver coinage. The re-casting of the large weights would cost less than a penny a pound, of which a part might be paid by the public, and part by individuals, on exchanging their old weights for new."

H. 4*. Mr. BIDDELL.

The decimal division of an acre into areas between a link and an acre would be very convenient for surveyors; their dividing the acre into roods and perches, and expressing the parts of a perch only by $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ (when they measure lower than a perch), is merely to assimilate scientific measures to those superficial measures which are commonly understood: and if the latter are not to be used, the division of the acre will be required into superficies much smaller than rods. The $\frac{1}{1000}$ part of an acre would do very well.

If a division of the acre, different from that now in use, be determined upon, of course it will be a decimal division; and its principal parts will be,—

1st. The square link	called Link.
2nd. The square of 10 links, or land-fathom	„ Fathom
3rd. The square of 100 links	„ Chain.
4th. Ten such squares	„ Acre.

As 5 of these square chains would be $\frac{1}{2}$ an acre, and $2\frac{1}{2}$ would be $\frac{1}{4}$ an acre, or rood, farmers would soon make the above division convenient to themselves in every thing but in rods and perches.

Upon consideration, I do not think that we farmers shall object to giving up the *rod* if you let us have, in measuring, the *land-fathom* and *square-chain* of 16 rods superficial. For although we should be sorely perplexed to assimilate fathoms and rods, we should get the rods from the chain either in length or superficies. Few of the alterations would cause [any temporary] inconvenience in accounts, or where measures have to be set down in writing; the inconvenience would only arise from the difficulty of altering habits of mind, so as to get *quick* and clear perceptions of the new values.

H. 10*. Mr. DE MORGAN.

Inch-tithe would be a good name for the tenth of an inch; it would become *inty*.

H. 10**. Mr. DE MORGAN.

No decimal scale is practicable that does not begin with the money.

H. 10***. Mr. DE MORGAN.

The Stock Exchange measures by eighths, because half-a-crown is handy. Make the money decimal, and it will immediately alter.

H. 10****. Mr. DE MORGAN.

With the present money, the hundred-weight of 112 lbs. has some advantages, though 120 would do better; $2\frac{1}{4}$ times the price of 1 cwt. in pounds sterling is the price of 1 lb. in pence. Thus £7 a cwt. is 15d. a pound.

H. 13*. Mr. GINGELL.

Your first question is a desire to obtain from me an estimate of the number of 14, 28, 56, and 112 lb. weights in use in my district, (allow me to inform you that the 112 lb. is not in use, the 5 & 6 Wm. IV. cap. 63, sect. 21, provides that no weight above 56 lb. shall be inspected or stamped, that being the greatest of the imperial standards of weight deposited in Her Majesty's Exchequer.)

In reply to this question, I feel upon high ground, as my calculation is founded upon my New Register, (a copy of which I had the honour to enclose you for your opinion with the models of my new system of weights and measures,) which gives me the number and class of each and every weight and measure examined and stamped by me in any one year, with the amount of fees in each case, from 56 lbs. to 1 oz., in iron weights, and 56 lbs. to $\frac{1}{2}$ dram., in brass weights; also from the bushel to the half-gill in measures. I have therefore sent you a copy enclosed for your guidance, embracing a period of *three years*, from 1838 to 1840. In a large city like this there are many hundreds of each class in use, yet never brought to this office to be examined or stamped, and of course not registered; there is also a quantity of each class registered to ironmongers in this city, and sold to the tradesmen residing in the adjoining counties of Gloucester and Somerset, and also in South Wales; these will about balance those not registered as observed above; therefore the gross number registered would be about the number used in my district.

Your second question is a desire to have the number of the inhabitants of this city and district. In reply to this question, I beg to state that the municipal boundary of this city embraces about 20 parishes, and its population is about 130,000. When the census is taken in June, it is confidently asserted that it will exceed 150,000.

(The following extract from Mr. Gingell's register includes all the weights of 14 lbs., 28 lbs., and 56 lbs.)

CITY AND COUNTY OF BRISTOL, REGISTER OF WEIGHTS.

	IRON.			BRASS.		
	56 lbs.	28 lbs.	14 lbs.	56 lbs.	28 lbs.	14 lbs.
1838	5,534	987	950	2	12	20
1839	2,625	546	641	1	3	9
1840	3,960	673	899	3	3	6
Total of each Class for the 3 Years.	12,119	2,206	2,490	6	18	35

H. 17*. Mr. MAY.

The price of pig-iron is now very low, and of course old weights are proportionably reduced in value; they are usually made with iron of the most inferior kind, and many will not bear re-melting alone. We should not like to give more than £3 per ton at this time.

For a large contract [for making new weights], say several thousand tons, I should not be surprised if weights of 50 lbs. could be had, adjusted, at £8 per ton; 20 lbs. at £8. 10s.; and 10 lbs. at £9. The only way of getting rid of the old weights would be to advertise for contracts for new weights, the parties taking the contract to take a given quantity of old weights at a fixed price. There would probably be a difference of 15 to 20 per cent. in the price of weights, if only a small quantity were required; but to define this more accurately, I will suppose you require 500 tons: this contract would be taken by almost any iron-founder; and it would not be sufficiently large to induce him to try novel expedients to reduce the cost of making: but if you want 5000 tons, the case is altered, as for this quantity parties having the peculiar knowledge required would start new foundries, and you would have offers at a much lower rate. Great care would be required in specifying; and pattern weights must be first prepared by some person, who, understanding the trade, would be able to judge of the shape that would take the least labour: a few hundred pounds spent in this way would probably save many thousands upon the whole contract.

H. 26*. Mr. WADE.

I have had some difficulty in finding out the population, as well as the number of weights, in my district. The population in 1831 was 245,860, to which may now be added about 22 per cent.; and I find by my books that I began to stamp the weights and measures on the 27th November, 1834, and made a return to the Secretary of State on the 28th of March, 1835, of 9460, of 56 lbs.; 1714, of 28 lbs., and 2394, of 14 lbs.; after that period they came in very slowly; but, as near as I can calculate by my books, as in the last four years the majority of weights have been fresh adjusted and re-stamped, I think I may add 2448, of 56 lbs.; 713, of 28 lbs., and 969, of 14 lbs.—making the total 11,908, of 56 lbs.; 2427 of 28 lbs.; 3363, of 14 lbs. in my district. With respect to 112 lb. weights—in 1835 there were not more than 20; there are now more than 100, as several coal-merchants, having discovered that no weight above 56 lbs. was to be inspected or stamped, have now substituted 112 lbs. for 56 lbs., and several have 224 lbs. in use.

WEIGHTS			MEASURES		
NO.	WEIGHT	MEASURE	NO.	WEIGHT	MEASURE
1	56 lbs.	1 bushel	1	56 lbs.	1 bushel
2	28 lbs.	1 bushel	2	28 lbs.	1 bushel
3	14 lbs.	1 bushel	3	14 lbs.	1 bushel
4	7 lbs.	1 bushel	4	7 lbs.	1 bushel
5	3 lbs.	1 bushel	5	3 lbs.	1 bushel
6	1 lb.	1 bushel	6	1 lb.	1 bushel
7	1/2 lb.	1 bushel	7	1/2 lb.	1 bushel
8	1/4 lb.	1 bushel	8	1/4 lb.	1 bushel
9	1/8 lb.	1 bushel	9	1/8 lb.	1 bushel
10	1/16 lb.	1 bushel	10	1/16 lb.	1 bushel
11	1/32 lb.	1 bushel	11	1/32 lb.	1 bushel
12	1/64 lb.	1 bushel	12	1/64 lb.	1 bushel
13	1/128 lb.	1 bushel	13	1/128 lb.	1 bushel
14	1/256 lb.	1 bushel	14	1/256 lb.	1 bushel
15	1/512 lb.	1 bushel	15	1/512 lb.	1 bushel
16	1/1024 lb.	1 bushel	16	1/1024 lb.	1 bushel
17	1/2048 lb.	1 bushel	17	1/2048 lb.	1 bushel
18	1/4096 lb.	1 bushel	18	1/4096 lb.	1 bushel
19	1/8192 lb.	1 bushel	19	1/8192 lb.	1 bushel
20	1/16384 lb.	1 bushel	20	1/16384 lb.	1 bushel

SECTION I.

EXTRACTS RELATING TO THE POSSIBILITY OF ASSIMILATING OUR SCALE TO THAT OF OTHER COUNTRIES.

[The variety as well in the absolute values of weights and measures as in the scales of weight and measure in different countries, may be seen in Kelly's Cambist. The papers which have reached the Commission add little to the general information on this subject. The following alone, in addition to those contained in the other sections, appear worthy of insertion.]

I. 1. *Austrian Papers.*

In the different parts of the Austrian dominions, there is an immense variety of weights, and considerable difference in the way of subdividing them. The values of all appear to have been carefully ascertained.

The Vienna ell, which is the measure of cloths, &c. &c., used in Austria Proper, and (for Government purposes) in all the provinces, is 779.19 millimetres.

The Vienna klafter is 1896.61 millimetres, divided into 6 feet, or 72 inches. A mile is equal to 4000 klafters; a joch is 1600 square klafters.

The Vienna metzen is equal to 61.527 litres.

The Vienna maass (for fluids) is 1.417 litres.

The schank-eimer is 40 maass.

By a decree of the Emperor, November 1, 1823, a metrical pound is declared to be equal (as found by accurate comparison) to 3 marks, 9 loth, and 48 richt-pfennigen of the Vienna mark-weight.

I. 2. *Dr. LAMONT.*

The system of weights and measures used at present in Bavaria was introduced by a Royal Decree of February 28, 1809, with the purpose of establishing one uniform system throughout the kingdom, and abolishing the numerous different systems then existing in the different towns and provinces. The new system is as follows:—

Unity of long measure, one foot, = 129,38 Paris lines at the temperature of +13° Reaumur. Subdivisions: inches, lines (decimal or duodecimal). Multiples: klafter = 6 feet; geometrische ruth = 10 feet; yard = 2 feet 10½ inches Bavarian measure, = 369,27 Paris lines.

Unity of square measure, one square foot; square klafter = 36 square feet; square ruthe = 100 square feet. Tagwerk (also called Morgen, or Tauchert) land measure = 40,000 square feet.

I. 2. Dr. LAMONT—*continued*.

Unity of liquid measure, one maasskane (or maass) = 43 decimal cubic inches, Bavarian measure; eimer = 64 maass.

Unity of corn measure, one metzen = $34\frac{3}{4}$ maasskannen. Subdivisions: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, metzen. 6 metzen = 1 scheffel = 208 maasskannen.

Unity of weight, one pound = 560 French grammes. One pound is equal to 32 lothe.

I. 3. Signor LANA.

Tables have been formed for comparison of the measures and weights used in the different parts of the Sardinian dominions, for uniformity is enforced only in the eleven provinces of Piedmont. The whole number of different kinds of weights and measures exceeds 400.

I. 4. Count MOLÉ.

The system of France, for several years past, has been a mixture of the *decimal metrical* system and the *usual* system (derived from the ancient scale of weights and measures, and sometimes preserving its names). It is intended to enforce the former, to the exclusion of the latter.

I. 5. *Prussian Law Instructions*.

§ 11. The Berlin *scheffel* shall contain 3072 Prussian cubic inches, and shall be 22 Prussian inches wide in the clear. 9 Prussian *scheffels* are consequently 16 Prussian cubic feet.

§ 12. The Berlin *metze* is a sixteenth part of the *scheffel*. It therefore contains 192 Prussian cubic inches; or 9 metzen are 1 cubic foot.

§ 13. The Berlin *quart* is a third part of the *metze*. Thus it contains 64 Prussian cubic inches; or 27 quarts are 1 cubic foot.

§ 14. The *eimer* contains 60 Berlin quarts; an *oxhoft* contains 3 eimers; an *ohm* 2 eimers; an anker $\frac{1}{2}$ eimer.

§ 15. The beer-tun contains 100 quarts.

§ 16. The tun for the measure of salt, lime, gypsum, coal, charcoal, ashes, and other dry goods, contains 4 Berlin *scheffels*; or 9 tuns are 64 cubic feet.

§ 17. The linseed tun, however, makes an exception to this, and contains for the future the content customary hitherto. According to this, 24 such tuns contain $56\frac{1}{2}$ Berlin *scheffels*; the tun contains $37\frac{3}{4}$ metzen.

§ 23. The stone and the ships' pound are no more to be used in public transactions. Instead of these, the Prussian ship-load (*shiffs-last*) shall contain 4000 pounds.

I. 6. *Russian Papers*.

3. La mesure linéaire aura, comme par la passé, pour base la sagène, équivalent à 7 pieds Anglais, et subdivisée en 3 archines de 28 pouces ou 16 Werschoks chacune.

SECTION K.

EXTRACTS RELATING TO THE CONSTRUCTION AND USE OF SECONDARY STANDARDS.

K. 1. Mr. BATE.

There is, under the present system, no further advantage to be derived by the public convenience with regard to weights avoirdupois, than that which would be probably the addition to the Exchequer standards of a weight of 112 lbs., but this would be a ponderous and unsafe weight for standard of reference, or verification of others similar to it.

There is, in my opinion, no necessity for a longer standard measure than the yard, as in commercial affairs that is generally employed as the unit of length: the foot measure may be useful as a standard of reference in some cases; but these would be by no means so general as the yard.

K. 2. Mr. BESSEL.

I only add, that I believe to have been successful in the solution of the problem, to procure copies of three Prussian feet, the error of which will not be greater than the five-thousandth part of a line. This, in the future, will be done by a regularly established process of business; so that such a copy, made of soft steel, and furnished with end pieces of hard steel, may be procured by applying to a board, which now will be established at Berlin. To standard such a copy will require two half-hours—one to-day, the other to-morrow.

K. 3. BESSEL's *Standard*.

The copy ought not to be made of any metal whose thermometrical expansion is very different from that of the steel standard. Moreover, it is not to be supposed that two bars of different metals lying side by side, can have exactly the same temperature, since they do not change their temperature with equal rapidity.

The copies are made of steel, the same size as the standard; but their ends, instead of sapphire, are of hardened steel. They are compared with the standard, and allowance is made for the error of the standard, and for the expansion of the standard to the temperature at which the comparison is made. Finally, an inscription like the following is engraved upon each copy:—

"18 . This bar, in the temperature of degrees of the centesimal thermometer,
measured along the axis of its cylindrical ends, is lines longer [or shorter] than
three Prussian feet."

(The method of comparing the copies is fully described: it requires observations separated by the interval of a few hours, but appears to be very easy, and to possess the highest accuracy. The copies are compared, not in spirits of wine, but in the air.)

K. 4. Mr. BLACKBURN.

If the two present legal standards of weight are continued, a larger or heavier set of troy standard weights must be made; for, at the present time, 12 oz., or 1lb., is the greatest troy

K. 4. Mr. BLACKBURN—*continued.*

standard the Exchequer can produce, and no higher authority than 11lb. can be obtained, although troy weights of 5lbs., 10lbs., 15lbs., 30lbs., and 50lbs., are in common daily use.

K. 5. Mr. BOWEN.

I have not been able to discover the authority for the allowance of the cubic inch (plus) on the verification of the bushel measure; but I am perfectly satisfied that it must have been that of a Treasury letter or minute, whether founded upon the recommendation of the Commissioners of Weights and Measures or not.

The copies, multiples, and parts of the standards deposited in the Exchequer, in pursuance of the Act 5 Geo. IV., cap. 74, are

TROY WEIGHTS.	AVOIRDUPOIS WEIGHTS.	MEASURES.
1 lb.	56 lbs.	1 yard with rod
6 oz.	28 lbs.	<i>Conical Shape.</i>
3 oz.	14 lbs.	Gallon
2 oz.	7 lbs.	Quart
1 oz.	4 lbs.	Pint
10 dwts.	2 lbs.	<i>Cylindrical Shape.</i>
5 dwts.	1 lb.	Bushel
3 dwts.	8 oz.	Do.
2 dwts.	4 oz.	$\frac{1}{2}$ bushel.
1 dwt.	2 oz.	Peck
12 grains	1 oz.	Gallon
6 grains	8 drachms	$\frac{1}{2}$ gallon
3 grains	4 drachms	Quart
2 grains	2 drachms	Pint
1 grain	1 drachm	$\frac{1}{2}$ pint
	$\frac{1}{2}$ drachm	Gill
	And 10 lb. weight for testing the gallon.	$\frac{1}{2}$ gill

K. 6. Mr. CHILD.

It would, in my opinion, be desirable to have standards of one, two, four, and five feet in length, also a standard of 112 lbs. weight, or the use of such be declared to be illegal, as at present the Inspectors have no standards to verify the same.

K. 7. Captain DAWSON.

Captain Dawson produced one of the standard chains of the Tithe Commissioners.

Captain Dawson endeavoured, at first, to use good measuring chains, taken from the shops of instrument-makers, which had been carefully adjusted; but they were often found $\frac{1}{2}$ an inch in error before they had been used at all.

The errors in land-surveyors' chains are frequently 2 or 3 inches. Captain Dawson has heard of an error of 11 inches.

It is common for land-surveyors to use chains 1 or 2 inches too long—not that they may become right by wearing—but to allow for the roughness of ground, and also for the sake of giving good measure in inclosures, &c.

The standard chains of the Tithe Commissioners are lent to surveyors in the country to be compared with the chains in use; they are then returned to the Tithe Commissioners, and are compared with fixed points in a wall.

Sometimes reports are made by country surveyors as to the comparison with their chains. In one instance a surveyor of eminence believed the standard to be 4 inches too short (his own being in reality too long by that quantity), and repeatedly urged this on Captain Dawson.

Captain Dawson has seen no anxiety to have stamped chains; but there has been much

K. 7. Captain DAWSON—*continued.*

anxiety to have chains of the exact length, principally perhaps for complying with the regulations of the Commissioners.

Captain Dawson has a standard foot on a brass bar, derived from the central foot of Simms's scale.

Foot scales are compared with this by Captain Dawson, and stamped with the letters T. C., surmounted by a crown. Instrument-makers frequently send foot scales to be stamped: no others will sell now.

On account of the expansion of ivory, Captain Dawson refuses to stamp ivory scales.

Some scales are found in error by $\frac{7}{3600}$ of the whole. The error which he allows to pass is the breadth of a line on his bar, about $\frac{1}{1000}$ of an inch.

K. 8. Mr. DE GRAVE.

I consider some standard larger than the 56 lbs. absolutely necessary. Many persons have weights of 112 lbs. for the purpose of evading the Inspectors' trying their weights, as Inspectors cannot legally use larger weights than those that are deposited at the Exchequer.

The only drawback for having so large a standard as 112 lbs. would be the inconvenience attending moving them from house to house. Either a larger weight ought to be at the Exchequer, or all weights ought to be declared illegal that were larger. The troy weights that are now at the Exchequer I consider almost useless, the largest weight being only 1 lb. Why larger troy weights were not placed at the Exchequer in 1824, has always appeared to me most unaccountable: had information been sought from persons who could have given it, I think larger ones would have been deposited there.

K. 9. Mr. DE GRAVE.

A standard for the foot measure ought to be placed at the Exchequer, that measure being frequently inquired for. I do not think a standard for the chain at all necessary.

K. 10. Mr. EDEN.

The fees paid for reverification, or verification of a full set of copies of the standards, is 1*l.* 14*s.*; if with troys, 3*l.* 8*s.* Formerly, the same fee was paid upon the verification of a single weight or measure as upon a whole set. To encourage the completion of copies of the standards in use (for, in some places in the country, we heard that bushel measures were tested by divisional parts of a bushel), in February, 1835, I requested the Lords of the Treasury to allow the fee to be reduced to nearly the fractional parts of the respective weights and measures; and their Lordships sanctioned the following scale. By proportioning the trouble of verification, the ancient fee of 1*l.* 14*s.* was divided, into 1*l.* for the measures, and 14*s.* for the weights. The whole capacity of a set of imperial measures is $126\frac{3}{4}$ pints—apportioning the fee to the contents of each measure, gives for the bushel measure about 9*s.* 4*d.*, and the fee paid is 9*s.* 6*d.*; the $\frac{1}{2}$ bushel, 4*s.* 8*d.*, the fee paid is 5*s.*; the peck, 2*s.* 4*d.*, the fee paid is 2*s.* 6*d.*; the gallon, 1*s.* 2*d.*, the fee paid is 1*s.* 6*d.*; and upon each of the smaller measures the fee paid is 1*s.* The imperial yard pays 2*s.* 6*d.* A set of avoirdupois weights consists of 16 pieces, their gravity 112 lbs.; and a fraction, apportioning to the weight of each the 16*s.* payable upon the whole set, would give, for the

	s.	d.		s.	d.
56 lbs. weight	7	0	Fee paid is	7	0
28 lbs. „	3	6	„	3	6
14 lbs. „	1	9	„	2	0
7 lbs. „	10	$\frac{1}{2}$	„	1	0

and for each of the smaller weights the fee paid is 1*s.*

K. 10. Mr. EDEN—*continued.*

I should add, that an indenture accompanies every set of copies of the standards verified at this office, to identify them. The stamp duty is 3*l.* 10*s.*

K. 11. Mr. EDEN.

Applications have been made to this office (the Exchequer) to verify foot measures for the trade, by America and by Russia.

K. 12. Mr. EDEN.

No doubt the Exchequer stamp would enhance the value of measures sold by the trade; but as all measures verified and stamped at this office must be accompanied by an indenture, the maker could not afford to have them stamped, were the fee ever so small.

K. 13. Mr. EDEN.

I have now only to remark, that should a new Act be passed to regulate the standards, a new complete set of troy standards are required for this office; at present, the troy standards only extend to 1 lb. troy. In the reign of Elizabeth, the troy standards were as under:—

256 ounces in one weight.			4 ounces in one weight.		
128	„	„	2	„	„
64	„	„	1	„	„
32	„	„	Two of 2½	dwt.	
16	„	„	One of 5	„	
8	„	„	One of 10	„	

I understand that in the City of London there are no copies of the troy standards. Westminster and the Founder's Company have complete sets, which were brought here for verification, but could not be tested. On a trial of the pix, the mint bring their own troy standards because ours are not sufficient, and we are obliged to use them on an occasion where we ought to have a set of our own as a check upon them.

K. 14. Mr. EDEN.

There was formerly in the Exchequer a standard of 112 lbs.; it is now in the possession of Sir Francis Palgrave of the Chapter House; how it came there is not known. In 1825, when the new standards were given to the Exchequer, the 112 lb. standard was not included in them. There has been certainly a want felt of a standard for the 112 lbs.

K. 15. Mr. EDEN.

Shape is a matter of opinion; but it is apprehended that the shape, thickness of metal, and the position of the handles of the standards of the Exchequer, are perfectly convenient.

K. 16. Mr. GILBERT.

The Commission ought without doubt to enter into an examination of the mode of comparison of commercial standards brought for verification.

K. 17. Mr. GILBERT.

There must be several recommendations in detail, as to copies of the philosophical standards which shall be authentic for all common purposes, and which may be renewed or multiplied by the Government at their discretion.

K. 18. Mr. GILBERT.

An accurate standard, or more than one, ought certainly to be kept for scientific purposes. Others should be sent to our principal colonies, and to various foreign states.

A certified coarse standard, or more than one, ought to be kept for commercial purposes.

K. 19. Mr. GINGELL.

The ordinary rule of 24 inches used in this [timber-measure] and other measures by architects, surveyors, and artisans, is of much greater importance in point of accuracy than the use of the standard yard in general merchandise, because it is used in measuring and valuing things of a more costly nature, as various timbers, marbles, architectural work, &c. &c.; the yard is more frequently used in the sale of articles under 6*d.*, and this is examined and stamped under the 5 & 6 of Wm. IV. cap. 63, to certify its correctness; the 2-foot rule referred to is not subject to any examination whatsoever.

K. 20. Mr. HASSLER.

In respect to the ratio between the dimensions of the dry measures, it is proper that their diameters shall be double their depth.

K. 21. Capt. KATER (Phil. Trans.)

Adopted a conical form for the gallon standard.

K. 22. Capt. KATER (Phil. Trans.)

Adopted for the weights (copied from the imperial standard) flattened spheres of brass, each having a cavity under a button for small pieces of wire.

K. 23. *Prussian Law Instructions.*

§ 2. From the original standards a second set is to be made, under the inspection of the Standard Commission, and is to be delivered to the Inspectors of Public Works (Oberbaudeputation) for preservation, as an accredited copy of the former.

A third set is to be deposited, as an accredited copy, with the mathematical class of the Academy of Sciences.

A fourth set is to be preserved in the Court of Justice (Kammergericht) for the support of the credit of other standards (zur Erhaltung des öffentlichen gerichtlichen Glaubens an die Identität und Ubereinstimmung mit den Originalen).

The Inspectors of Public Works, the mathematical class of the Academy, and the authorities of the Court of Justice, are to assure themselves of the continued agreement of their copies with the original, as often as necessary, and at least once in every ten years, by sufficient comparison and correction in case of need, and to publish the papers thereto relating in the Gazette of each department (die darüber aufgenommenen Protokolle durch Abdruck in den Amtsblättern jeder Regierung bekannt zu machen.)

K. 24. M. QUETELET.

Nous devons rapporter [de Paris], avec les deux étalons en platine, un instrument comparateur pour construire des étalons secondaires et multiplier ensuite les mesures qui seront distribuées dans les différentes provinces.

K. 25. Mr. REEVES.

The use of the following measures is so general, no doubt can arise as to the expediency of having standards wherewith to compare them. These are the measuring chain, the one-foot and two-foot rule, and the measuring rod of builders. But as regards the hundred-weight, the information obtained from weight-makers leads to the belief, that the weight of that denomination might be included in prohibited weights, the inconvenience of so much weight in one bulk operating nearly as an abolition of its use. The five and three-gallon measures are in sufficient general use to require the provision of standards of comparison.

K. 26. Mr. REYNOLDS.

In measures of length, I have but one standard, which is the yard; I consider that there should be one, two, four, and five-foot standards, as well as the chain length, which are much more used by the public than the yard measure.

With weights there should be a standard of 112 lbs. (which the Exchequer have in their possession, although at the passing of this last Act, I believe they were not aware of it), also 224 lbs., which are both much used in my district, and would be more so if there were standards to test the same.

There is also a necessity of a nine-gallon standard measure of capacity; the same applies to county or local standards.

K. 27. *Sardinian Laws.*

1. There shall be made standards of the fundamental lengths, weights, and measures, actually in use in every province. Copies of these are to be deposited in the archives of the Government (archivi camerali), and other copies in the archives of the principal city of each province.

All existing standards are to be transmitted to the Secretary of the Chamber of Finances, for examination by the Inspector of Weights and Measures, and (if approved as of proper construction) to be compared with the metrical standards.

2. On each of such standards is to be marked its name and its value in metrical measures.

3. Standards of metrical weights and measures shall be formed and deposited in the archives of the Government.

4. Those weights and measures shall be suppressed which (according to the particular circumstances) the magistracy shall think right to suppress, and others substituted which may be better known in the neighbourhood.

5. The magistracy shall, as early as possible, compile and publish tables of the comparison of the various local weights and measures, with the metrical weights and measures.

6. The office of Inspector of Weights and Measures fixed at Turin, is preserved.

7. It is the duty of the Inspector to verify and mark the weights and measures for the use of verifiers and standard-men (campionieri), and to ascertain their agreement with the standards of the Government. He is also to inform the Procurator-General of any abuses in the fabrication and adjustment of standards, for the providing of means of preventing them.

8. A duplicate of each of the Government standards shall be intrusted to the Inspector, being first duly compared in presence of the proper commission.

K. 28. Mr. SIMMS.

The plotting scale of the surveyor being usually one foot, and the carpenter's rule two feet in length, such local standards would have the effect of restoring as well as preserving uniformity in these particular kinds of measures. Each rule-maker in every part of the kingdom has his own pattern or standard, the divisions of which he copies upon his work, and although these measures may have originally emanated from the same source, the diversity that now exists is hardly to be credited; in most cases, it is such as not to deserve notice in an ordinary rule, but is of importance in the case of a plotting scale, when on account of these irregularities the several parts of a plan cannot be combined. There may be other cases with which I am unacquainted, where these particular lengths are made use of, but from these considerations I think it desirable that such standards should be kept at the Exchequer.

K. 29. Mr. SIMMS.

It appears to me at least equally important that the Gunter's chain of 22 yards should be preserved, and that there should be authenticated copies of it in every considerable place in the

K. 29. Mr. SIMMS—*continued*.

kingdom, to which reference might be made by the surveyor. The different determinations of the same area, arising from want of uniformity in the length of the chains employed, give rise to all sorts of inconvenience and litigation.

K. 30. Mr. SIMMS.

Unless any other use exists for the 2-feet standard, beside that which is above stated, namely, the comparison of carpenters' rules, I think the measure and bed the most convenient form, and sufficiently accurate for the purpose; but the divisions of a plotting scale being cut upon a *feather edge*, can be best compared either by lines upon a plane surface, or by microscopes. Capt. Dawson, R.E. has at the Tithe-office, Somerset House, a convenient apparatus of this kind, by which scales of one foot may be compared and their errors determined with ease and rapidity.

K. 31. Mr. SIMMS.

As to the form of a standard of 22 yards—the ordinary chains being made of iron, it appears desirable that the standard should be of iron also. Eleven bars, each 2 yards long, might be laid in a straight line upon a platform with their ends in contact, the local standard might then be *set off*, by extending the latter by the side of the former, and cutting fine lines upon brass blocks secured for that purpose, to the ends of the chain described hereafter (*see* Section L).

K. 32. Messrs. WARNER.

We consider the foot length is required as an Exchequer standard. We know not whether the chain length is required. We are fully satisfied of the necessity of there being either a 100 lb. or 112 lb. avoirdupois weight as an Exchequer standard, and consider the 100 lb. the most desirable, provided the smaller weights were to correspond, viz., a set containing the following, 100 lb., 50 lb., 25 lb., 10 lb., 5 lb., 4 lb., 3 lb., 2 lb., 1 lb., would be much more convenient for calculation and more readily comprehended by foreigners. The same answers will equally apply to the county or local standards.

We think there can be no necessity for two sorts of weights, viz., troy and avoirdupois. We would recommend the discontinuance of the troy, and that the avoirdupois pound should henceforth be considered the standard of England, being more generally used and understood; but if troy weights are thought necessary and continued, we think it absolutely necessary there should be standards for larger weights than are at present deposited in the Exchequer office, the 1 lb. being the largest there. It is not long since we had an order to reverify a set of troy weights similar to the old Exchequer set containing 512 ozs., which could not be complied with, because the largest new weight was only 1 lb.; this must have been a great oversight, the Founder's Company having a set of 512 ozs., and the same we think at the Mint, as well as many in common use much larger than the pound, as we are constantly making them.

K. 33. Messrs. WARNER.

We consider the best metal for standard weights and measures, is a compound metal called gun-metal, not being liable to oxidize to any extent; whereas the metal of which the Exchequer standard weights are composed, is more liable to oxidize than any, and one of the worst that could have been thought of to stand the test of time, a large proportion of zinc being part of their composition; and the effect of the air may be seen on those at the Exchequer; they were covered some years since with a white crust of oxide, and we have little doubt that if they were examined carefully, they would be found to have lost some of their original weight.

We consider the best shape for standards of capacity is cylindrical.

SECTION L.

EXTRACTS RELATING TO THE CONSTRUCTION AND USE OF LOCAL STANDARDS.

L. 1. Mr. BATE.

The various local weights and measures should be reverified at least every five if not four years at the Exchequer, who do not now require a fresh stamped indenture every time, which is a saving of 70s. on every set; and the re-adjustment does not average more than 12l., including the Exchequer fees, 34s.; these are always more if a set of troy weights are to be re-adjusted or examined at the Exchequer, whose fees, for troy weights alone, amount to 34s.

L. 2. Mr. BATE.

I can mention two cases which struck us as remarkable in illustration of the different degree of care with which standards were treated in the custody of different Inspectors, viz.—the Worcester 56 lbs. weight was found to be only 10 grains light, after cleaning and previous to re-adjustment; this weight must have been carefully used: the other was a Tewkesbury weight of 28 lbs., which, after similar cleaning, proved to be about 30 grains too light. In another case, it may be worth while to notice, that a set of weights and measures was, owing to the ignorant assiduity of the person to whom the custody of them was confided by the Northumberland magistrates, very much injured, as the party himself boasted of keeping them so clean and bright.

The errors of the former two were incurred during a lapse of eight years; and we should say, from the general practice that we have had, that the majority of flagrant abuses of the county standards would be as in the case of the Tewkesbury 28 lbs. weight.

L. 3. Mr. BATE.

Whatsoever weights or measures of length or capacity are deposited in the Exchequer as lawful standards, copies of each should be in the hands of Inspectors of Counties, authorized by the magistrates of such counties; that, when called upon, they may be enabled to compare and stamp any one such weight and measure as an Act of Parliament may prescribe.

L. 4. Mr. BATE.

Bell-metal, a mixture of copper and tin, is a very tough and durable substance, which we always prefer for measures of capacity, as it runs freer, and is of a closer texture, than brass. The best and most commodious figure for these is a cylinder equal in diameter to its depth. We use brass for the weights, as it is less liable to corrosion, and it is a cheap material; the best figure for these is spherical for standards of reference.

L. 5. Mr. BATE.

Tradesmen's weights should be compared by Inspectors by means of counterpoise, so that all errors of the length of arm of the Inspector's balance may be disregarded. The best mode of comparing the measures is through the medium of water; other modes, such as sand or seed, being very far from constant in their own comparisons.

L. 6. Mr. BLACKBURN.

The standards of the different cities, ridings, shires, towns, &c. &c., ought constantly to be examined, re-adjusted, and verified, at least every 12 or 18 months. Many cases have come under my immediate knowledge, when, in the course of two years, the standard and weight of 56 lbs. has become by wear $1\frac{1}{2}$ ounce light, and the smaller weights light in proportion; but as it is to be feared the magistracy will never attend to suggestions, it would be advisable to make this compulsory, with a very heavy fine.

L. 7. Mr. BOWEN.

A Statement shewing the number of sets of Weights and Measures, which have been stamped at the Exchequer, since the Act 5th Geo. IV. cap. 74, to July 5, 1838; distinguished by the classes of—1. Troy Weights; 2. Avoirdupois Weights; 3. Yard Measures; 4. Measures of Capacity.

YEAR.	ENGLAND.				WALES.				SCOTLAND.				IRELAND.				COLONIES.				TOTAL.			
	Troy.	Avoir.	Yard.	Meas.	Troy.	Avoir.	Yard.	Meas.	Troy.	Avoir.	Yard.	Meas.	Troy.	Avoir.	Yard.	Meas.	Troy.	Avoir.	Yard.	Meas.	Troy.	Avoir.	Yard.	Meas.
1825	..	63	57	66	..	6	6	6	..	7	5	6	..	..	..	..	..	..	..	..	..	76	68	78
1826	6	179	146	180	2	13	12	14	8	57	56	56	1	23	23	23	..	..	..	..	17	272	237	273
1827	2	31	25	30	..	..	..	..	..	..	..	..	..	5	5	5	..	..	..	..	2	36	30	35
1828	..	12	4	10	..	..	..	..	..	..	..	..	..	3	3	3	..	..	..	..	..	15	7	13
1829	..	4	..	5	..	1	..	1	..	..	..	..	1	..	..	..	3	3	..	3	4	8	..	9
1830	..	6	3	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	3	6
1831	..	8	3	6	..	..	..	..	..	1	1	1	..	..	..	..	..	1	..	..	..	10	4	7
1832	..	2	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	2
1833	1	2	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	2	..	2
1834	9	93	84	89	..	..	..	..	..	2	2	2	..	2	2	2	18	18	18	18	27	115	106	111
1835	48	153	149	151	1	3	4	4	3	15	13	15	1	33	35	33	3	5	5	5	56	209	206	208
1836	4	35	27	34	..	1	1	1	..	3	2	2	..	5	5	5	..	1	1	1	4	45	36	43
1837	2	8	8	9	..	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..	2	9	9	10
1838	1	2	2	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	2	2	1
Total .	73	598	510	591	3	25	24	27	11	85	79	82	3	71	73	71	24	28	24	27	114	807	710	798

In the Year 1833 commenced the reverifications, for which see the accompanying statement.

L. 8. Mr. BOWEN.

A Statement shewing the number of sets of Weights and Measures, which have been re-stamped and reverified at the Exchequer, since the Act 5th Geo. IV. cap. 74, to July 5, 1838; distinguished by the classes of—1. Troy Weights; 2. Avoirdupois Weights; 3. Yard Measures; 4. Measures of Capacity.

YEAR.	ENGLAND.				WALES.				SCOTLAND.				IRELAND.				COLONIES.				TOTAL.			
	Troy.	Avoir.	Yard.	Meas.	Troy.	Avoir.	Yard.	Meas.	Troy.	Avoir.	Yard.	Meas.	Troy.	Avoir.	Yard.	Meas.	Troy.	Avoir.	Yard.	Meas.	Troy.	Avoir.	Yard.	Meas.
1833	..	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	1
1834	..	11	9	10	..	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	12	10	11
1835	5	28	26	26	..	1	1	1	..	..	..	..	1	1	1	1	..	..	..	..	6	30	28	28
1836	..	5	3	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	3	3
1837	2	10	6	8	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	11	6	8
1838	..	3	2	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	2	3
Total .	7	58	47	51	..	3	2	2	..	..	..	..	1	1	1	1	..	..	..	..	8	62	50	54

L. 9. Mr. BOWEN.

Memorandum, June 6, 1838.—A set of weights belonging to the county of Surrey, which were compared and verified with the standard on the 24th September, 1836, were again brought to be tested, when, upon trial, they were found as under:—

56 lbs.	10 grains light.	1 lb.	2 grains light	4 drachms, right.
28 lbs.	18 „	8 ozs.	1 „	2 drachms, right.
14 lbs.	2 „	4 ozs.	1 „	1 drachm, light.
7 lbs.	7 „	2 ozs.	1 „	$\frac{1}{2}$ drachm, light.
4 lbs.	2 „	1 oz.	right.	
2 lbs.	5 „	8 drachms,	light.	

The above set has been three times reverified; in the two former reverifications the weights were also light.

L. 10. Mr. CARRUTHERS.

I beg leave to hand you, for your information, the deficiency upon a set of avoirdupois weights sent to this office a short time since for reverification, from the city of Coventry, which have been in use since 1826.

56 lbs.	118 grains light.	2 lbs.	13 grains light.	1 oz.	2 grains light.
28 lbs.	46 „	1 lb.	10 „	8 drachms	$1\frac{1}{2}$ „
14 lbs.	38 „	8 ozs.	6 „	4 drachms	$\frac{1}{2}$ „
7 lbs.	36 „	4 ozs.	4 „	2 drachms	$\frac{1}{2}$ „
4 lbs.	23 „	2 ozs.	2 „	1 drachm,	correct.

L. 11. Mr. CARRUTHERS.

I have had a set of weights from Mr. Bate, for the county of Chester, for reverification; they have been in use only since February, 1835. He tested them, and found them deficient, as stated in the enclosed account.

L. 11. Mr. CARRUTHERS—*continued*.

Account transmitted by Mr. Bate:—

On weighing a set of weights belonging to the county of Chester, find them all light, and very much bruised.

56 lbs. — 65 grains.	1 lb. — 7 grains.	8 drachms — 0·7 grain.
28 lbs. — 60 „	8 ozs. — 2·5 „	4 drachms — 0·5 „
14 lbs. — 40 „	4 ozs. — 2 „	2 drachms — 0·4 „
7 lbs. — 30 „	2 ozs. — 1·6 „	1 drachm } made in
4 lbs. — 22 „	1 oz. — 1·3 „	$\frac{1}{2}$ drachm — 0·4 } the county.
2 lbs. — 12 „		

L. 12. Mr. CHILD.

I think the metal and shape of the standards now in use at my station are the best, being least liable to wear, or affected by the action of the atmosphere, viz., brass manufactured spherical.

L. 13. Mr. CHILD.

Not having been present at the Exchequer, when our county standards were reverified, I can form but little idea as to the amount of wear; but there is no question in my mind, that, in order to secure that accuracy which is of the first importance, reverification should be enforced by Act of Parliament every two or three years.

L. 14. Mr. CHILD.

The measures of capacity most in use are pints and quarts: those of length are, I think, the 2-foot rule, also 4 and 5 feet; but there should be *no weights or measures allowed to be used, under any circumstances*, but those bearing the mark of some Inspector, after due verification.

L. 15. Mr. CUBITT.

I think that a plain standard of reference for measures of length should be affixed in some accessible place in the chief town of every county at least, to which all persons might have access to check the length of a 1-foot rule or scale, a 2-foot rule, and a yard. Such a standard might be made very simple and very cheap; and, if thought of sufficient importance, I should feel much pleasure in supplying the Commissioners with a model of the thing I mean.

L. 16. Mr. DE GRAVE.

All copies of the standards that are supplied for the use of counties, cities, boroughs, &c., ought to be the same, both as to size, number, and metal, as the standards that are deposited at the Exchequer.

L. 17. Mr. DE GRAVE.

The amount of the wearing of standards varies very much: some sets are taken from place to place in a cart; others are kept in one place, or carried about by hand. I have known the 56 lbs. to be more than 2 ounces deficient, and the smaller ones in proportion. I refer to sets that have been out for many years—sets made in 1825-6-7, on being reverified, 1834, have varied considerably, the 56 lb. weight from 3 drachms to 1 drachm; and, on all occasions, the drachms, if not the ounces, so light, as to render new ones necessary.

L. 18. Mr. DE GRAVE.

All local standards ought to be reverified within a certain period: were that the case, the standards in the country would be much more correct than they now are; and to insure that

L. 18. Mr. DE GRAVE—*continued.*

reverification, I consider an Act of Parliament would be requisite, being satisfied, unless that were the case, Inspectors will always go on as they now do, without considering whether these standards are correct or not. After giving much attention to this part of your letter, I am of opinion that weights ought to be adjusted more frequently than the measures, the weights every three or four years at farthest, and the measures every six or eight years, and that under penalty.

L. 19. Mr. DE GRAVE.

A mixture of tin and copper, or, in other words, gun-metal, I consider the best metal for all standards, being much harder than what is termed yellow brass, which is a mixture of zinc and copper. The present standards are made of yellow brass; and I am of opinion that, if those that are now at the Exchequer were examined (even where so much care is taken of them) that they would be found deficient of their original weight. I never sold standard weights made of yellow brass prior to 1824; but since that period always have sold them made of yellow brass, the Exchequer standard being made of that metal. I consider the cylindrical shape for local standards to be the best, and more convenient than any other shape, and I also consider that all standard measures should have a fixed diameter and depth; and after much consideration, I am of opinion that the diameter should be the same as the depth of every measure, large or small: the shape of the measures that are used at the Exchequer, is, in my opinion, very bad, as they bear no proportion whatever in shape one to the other, the bushel, half-bushel, and peck, differing entirely from all the others.

L. 20. Mr. DE GRAVE.

The best mode of examining the weights and measures of the public, is for the Inspector to take his standards and examine both weights and measures at the place where they are used, but which ought not to be done at stated or fixed periods, but when the Inspector thinks proper.

L. 21. Mr. EDEN.

It is a defect in the Act 5th & 6th Wm. IV. cap. 63, and which at the time I pointed out to the House of Commons' Committee, that the copies of the standards are not compelled to be brought periodically to the department of weights and measures for reverification. The wear is considerable, and subjects to great inconvenience those manufacturers whose weights and measures have to be tested by copies of the standards damaged by use. Experience here shews that the weights diminish by use in gravity to a degree greater than might almost be expected.

L. 22. Mr. EDEN.

If a new Act is passed, it would be very useful to compel, under penalties, the copies of the standards to be periodically reverified, say, the weights once in 3 years, the measures once in 6 years. (I represented this to the House of Commons' Committee of the Weights and Measures). At present the trade is exposed to great injustice, for weights and measures are oftentimes tested by copies of the standards, deficient by wear and tear.

L. 23. Mr. EDEN.

No doubt, if the copies of the standards are directed by Act of Parliament to be periodically verified, it will be useful to have the year of the original verification stamped on them.

L. 24. Mr. EDEN.

Almost all the weights and measures brought to this office for verification, are previously sent to the manufacturer for adjustment, so we cannot give you officially the wear and tear of the copies of the standards in use by the Inspectors. One set from Kirton Lindsey sent to this office was deficient in the

56 lbs. weight—66 grains.	4 lbs. weight—15 grains.
28 lbs. ,, —38 ,,	2 lbs. ,, — 8 ,,
14 lbs. ,, —10 ,,	1 lb. ,, — 4 ,,
7 lbs. ,, — 6 ,,	

Also all the smaller weights were light.

L. 25. Mr. EDEN.

The prices of the copy of the standards are various, according to the quality of the metal, and the finishing of them; also whether made by a London maker, or in the country; we have heard from 70*l.* to 100*l.*

L. 26. Mr. GINGELL.

Reverification of standards is a subject of very grave importance to the public; there is no compulsory clause in any of the statutes to compel corporate or other public bodies possessing a copy or copies of the imperial standard to send them to Her Majesty's Exchequer to have the same reverified.

L. 27. Mr. GINGELL.

A heavy penalty ought to be levied upon persons possessing a copy or copies of the "Exchequer standard," unless the same was reverified every three years, or oftener if required, and which would be endorsed on all the indentures sent therewith. No conviction ought to take place upon defective standards; it would be unjust towards the parties concerned, and much depends on the Inspector in the care of these standards, in having them properly secured from injury: very little attention is paid by public bodies to have scientific balances for testing; from false economy, a beam and scale that would disgrace a grocer's shop, is exhibited in justice-rooms to decide cases of reported fraud.

L. 28. GLASGOW COMMITTEE.

It certainly would be expedient, that the duplicates, which by the clauses in the Bill for providing models and copies, are ordered to be provided by magistrates of counties, &c., should be authenticated by being marked, as well as "compared and verified" by the Chamberlain of Exchequer.

L. 29. Mr. HAYMAN.

There are from 400 to 500 sets of standards, issued from the Exchequer in or about the year 1825: there being no time limited, nor penalty affixed, a large majority of these standards are still in use, not having been subjected to any legal or proper examination during the whole of that period. As far as my observation goes, there are no two persons who think alike with regard to the standards; many seem to suppose, because they are made of brass, and are turned out of hand most carefully and accurately at the Exchequer, and a written indenture given, that therefore they will of necessity always retain their accuracy.

It is very customary to polish them, to expose them to the action of atmospheric air, and to subject them to friction for many years, and yet they are supposed to remain quite correct, and even the Legislature seems to have fallen into this error, for (Gul. IV. cap. 63, sec. 4) it is

L. 29. Mr. HAYMAN—*continued.*

enacted, that standards once verified at the Exchequer, are to be deemed legal, without any reference whatever as to their accuracy, and without any limitation as to the period of their being adjusted. I should probably not have noticed the inaccuracy of standards, but it happened that having introduced a new method of proving the accuracy of measures intended for ordinary use, I, of course, had occasion to get such measures stamped in various counties; on tendering them, however, for this purpose, I frequently had them rejected as inaccurate, and being confident of the correctness of my own plan of trying their contents, I named the subject to Lord Ebrington, who caused them to be examined at the Exchequer, when the same difference for which my measures were rejected, was found to exist in the standards themselves. I then pursued the inquiry, and caused those belonging to the county of Surrey, parishes of St. Pancras, and St. Marylebone, to be examined at the Exchequer, on the 14th December, 1835; they all proved defective and erroneous, and it should be remarked that many sets of standards throughout the kingdom are subjected to more work and worse treatment than those I have named. With regard to the effects produced by such inaccuracies, I would just refer to the fact of there being from 400 to 500 sets of erroneous standards, issued in 1825, and as many more say correct ones, issued at the passing of the late Act, and I might add twice that number now in use not verified at all. When it is remembered that these standards are put into the hands of persons having concurrent jurisdictions, and that therefore the public are brought in contact alternately with perfect and imperfect standards, great inconveniences must occur.

L. 30. Mr. HAYMAN.

I am of opinion the material of which the weights are composed, is a highly improper one. I mean brass: it seems to me far too soft in its nature, and unfit to undergo friction. I noticed particularly when the work of stamping was in progress, that all the brass weights came to hand much more light and defective than any others. I should also be inclined to question the propriety of having the standard bushels the shape they now are; the Committee will observe, by Gul. IV. cap. 63, sec. 7, the heaped measure is abolished, and therefore, for the more easy comparing measures with the standards, it would be better that they agreed in shape. I am aware the meters' bushels remain that shape, and I would not suggest any alteration that would affect them; but to every meters' bushel which had to be stamped, there are many hundred upright or drum bushels. I can only say, that so long as the standards are $19\frac{1}{2}$ inches across, and the corn bushel from 14 to 16 inches, there will ever be a difficulty.

The cubic inch excess now permitted at the Exchequer to exist in the bushel standard, would be best withdrawn, because if some of the bushels have that excess in their contents, and others not, it must (as it has done) cause many correct measures to be rejected, and much expense and inconvenience must accrue.

L. 31. Mr. HAYMAN.

There is one point yet to which I beg to solicit your attention; I mean the system which I believe in most parts of the kingdom exists to a greater or less extent, of using weights and measures as standards, which have never been verified at the Exchequer at all. I think this practice exists chiefly amongst persons claiming to act under long established customs, chartered or local right; persons, for instance, who act under a precept from the Lord of a Manor; these persons think if they hold a set of weights and measures which their predecessors called standards, that therefore they must be correct and legal standards, although never compared with the originals in the Exchequer. There are very many persons in this situation, and even in the City of London the 26 ward inquests have no proper regulation as to this matter; they neither take their ward inquest standards to their own Guildhall, nor to the Exchequer.

L. 32. Mr. HAYMAN.

The standards ought to be examined at the Exchequer at least every third year, and the use of any weights or measures as standards not being duly verified, should be visited by a heavy penalty: the Committee will please observe, I make no complaint against any officer in the Exchequer, on the contrary, I admire the scientific care and attention with which the duties of that department are conducted.

L. 33. Mr. HAYMAN.

Remarks on the Act now in force:—

Clause 4. By this clause all weights and measures once verified at the Exchequer are taken and deemed to be legal standards, however inaccurate; there is no time limited at which such copies of standards are to be verified at the Exchequer.

Clause 5. This clause is equally bad, because by it, defects in standards are to be detected by merely looking at them, whereas it is clear such defects can only be determined by comparison with the originals in the Exchequer.

Clause 21. Persons take advantage of this clause to their own profit, by using hundred-weights instead of 56 lbs., and thus avoid any inspection.

L. 34. Mr. HAYMAN.

State of St. Marylebone Standards, as taken at the Exchequer, 14th December, 1835:—

WEIGHTS.		MEASURES.	
56 lbs.	10 grains too heavy.	1 bushel	2½ cubic inches too large.
28 lbs.	5 grains too light.	½ bushel	correct.
14 lbs.	2 grains too light.	1 peck	½ cubic inch too small.
7 lbs.	correct.	½ peck	correct.
4 lbs.	4 grains too light.	¼ peck	correct.
2 lbs.	2 grains too light.	1 quart	correct.
1 lb.	1 grain too light.	1 pint	correct.
½ lb.	2 grains too light.	½ pint	correct.
¼ lb.	too light.	gill	correct.
2 ozs.	correct.	½ gill	correct.
1 oz.	too light.		
½ oz.	too light.		
¼ oz.	too heavy and not stamped.		
2 drachms,	correct.		
1 drachm,	too heavy and not stamped.		

State of St. Pancras Standards, taken same date:—

WEIGHTS.		MEASURES.	
56 lbs.	12 grains too light.	1 bushel	correct.
28 lbs.	4 grains too light.	½ bushel	injured and erroneous.
14 lbs.	7 grains too light.	1 peck	correct.
7 lbs.	8 grains too light.	½ peck	too small.
4 lbs.	7 grains too light.	¼ peck	correct.
2 lbs.	7 grains too light.	1 quart	correct.
1 lb.	3 grains too light.	1 pint	correct.
½ lb.	1 grain too light.	½ pint	correct.
¼ lb.	too light.	gill	correct.
2 ozs.	too light.	½ gill	correct.
1 oz.	correct.		
½ oz.	too light.		
¼ oz.	too heavy and no Exchequer stamp.		
2 drachms,	correct.		
1 drachm,	correct.		

L. 35. Mr. HOWLETT.

Knowing the negligence of surveyors in checking their chains, I borrowed one that had been tried about a year before in this office, and which had been used for that period in the service of a civil engineer. Upon trying it with my standard, I found it thirteen inches too long. The person who used it said he knew twenty other chains then in use that must be just as bad. The effect of this error would be this; if I possess a square mile of land, or 640 acres, this surveyor, with the chain in question, would report the content to be 619½ acres, so that selling my land at say 30*l.* an acre, I should lose 615*l.*

In the colonies this evil is very serious; for in setting out county and parish lines by chains of different lengths, the discordance and confusion among the details is endless, and will at some time cause dissatisfaction. In 1820, the Solicitor-General to a colony, and the agent of a nobleman who had possessions there, informed me that the discrepancies in the admeasurements were enormous.

The chain to which I have alluded was one of the best kind. The error was chiefly caused by the stretching of the wire itself, not one of the links or rings having opened; there was nothing in its appearance to indicate that it was incorrect, except that it was a little worn, and the surveyor would have continued to use it in that state as long as it would have held together. He had never been instructed that during a survey a chain should be frequently checked and adjusted by a standard.

Strange as this may appear, I believe it to be a common case. Surveyors in general have no proper standards by which to check their chains and measures; and as regards actual practice, it will be found that most measures can be traced to no better authority than to carpenters' rules, no two of which agree. The standards offered to the public are usually brass scales, at the price of about eight guineas, but owing to their delicate nature and high price they are little used.

First. A standard scale should be provided by the Government as the unit of measure for the empire; and the scale should have the necessary apparatus for enabling comparisons with it to be readily made.

Second. All surveyors should be compelled to have a stamped standard measure, and be liable to a fine if their chains and other measures be found incorrect.

(A plan of a proposed standard and apparatus for comparison, is given by Mr. Howlett.)

L. 36. *Prussian Laws.*

§ 4. The commission established at Berlin is also bound, as often as required, to examine the standards of the other commissions, and to direct the construction of standards, for the accuracy of which it will be responsible, on assurance of indemnity for the expenses.

§ 5. Every commission has a set of standards. It is bound to assure itself of the continued agreement of its standards with those of the Berlin commission, by comparison (and repair if needed) as often as is necessary, and at least once in every five years. The papers relating to this [comparison] shall be preserved in the department.

§ 8. At every stamping office there must be fixed in some open place a metallic foot-measure divided into inches, and an ell, by which every person may test the accuracy of his measures without expense. The office is to take care for the maintenance of these public (öffentlichen) standards. In the largest towns of the empire there shall also be, on the outside of some proper public (öffentlichen) building, a half-rod (halbe-ruthe) cut in stone, or made of cast iron.

L. 37. Mr. REEVES.

If the Inspectors of Weights and Measures should become actively employed, the standards ought to be reverified about every third year, and an account should be kept at the Comptroller General's office, of the time of examination of each set of the copies in use in the kingdom, with power to enforce a compliance within three months after the expiration of the third year from the date of verification.

L. 38. Mr. REEVES.

The metal now used is as little liable to wear or corrosion, as can be found, but the shape of the standards of the bushel and half-bushel measures is objectionable; and if measure is to be continued for dry goods, instead of being flat and broad, they should be of the shape of the corn bushel, &c. in use, by which greater accuracy would be obtained in comparison.

L. 39. Mr. REYNOLDS.

I have no means of ascertaining the amount of wear in my standards. I think it very important that our standards should be reverified at the Exchequer, and that it should be enforced by Act of Parliament (as a difference has been ascertained in some of the county standards) I should say every two years.

L. 40. Mr. REYNOLDS.

The local standards should be made of brass, and the weights of spherical shape, being much less subject to wear.

L. 41. Mr. REYNOLDS.

I beg to refer you to the following return of weights and measures, stamped by me from December 1834, to August 11th, 1838:—

BRASS WEIGHTS.		WOODEN MEASURES.	
	No.		No.
$\frac{1}{2}$ cwt. to a stone	22	Bushels	86
Under a stone to 1 lb.	178	$\frac{1}{2}$ bushel	163
Under 1 lb.	12,277	Peck and under	2,266
Sets of 1 lb. and under	1,827	Yard	1,590
	<u>14,304</u>		<u>4,105</u>
IRON WEIGHTS.		MEASURES OF CAPACITY.	
	No.		No.
$\frac{1}{2}$ cwts.	16,332	Five gallons	8
$\frac{1}{4}$ cwts.	2,228	Four gallons	101
Stone	1,596	Three gallons	9
Under a stone	26,775	Two gallons	101
1 set	7	One gallon	318
	<u>46,938</u>	Half-gallon	339
		Quart and under	168,103
			<u>168,979</u>

Total amount of fees for stamping the same, £945 11s. 3½d.

L. 42. Mr. REYNOLDS.

Before going any farther, I beg to remark that there are at present, in consequence of the imperfect state of this Act, thousands of weights and measures that have never been stamped nor even tested for years, in addition to the weights of 112 lbs. and 224 lbs. each, as well as measures of 9 gallons, &c. that we have no power to examine, nor standards to test.

L. 43. Mr. SIMMS.

If the local standards of one foot be lines upon a plane surface, then a comparison with a plotting-scale would be made by simply laying the latter upon the former, and if that of 2 feet

L. 43. Mr. SIMMS—*continued.*

were a measure and bed, then the carpenter's rule might be tested, by merely dropping it into the bed. If local standards of 3 feet, consisting of a measure and a bed, be supplied, then perhaps all practical purposes might be answered by having the measure accurately divided into 36 inches.

L. 44. Mr. SIMMS.

I would recommend the local standard chains to be made of iron wire, and consist of 25 parts, each 31·68 inches long, terminating in loops, by which the several parts are connected together, similar to that known as Troughton's standard chain. At each extremity a brass block is fixed, having a line cut upon it, which lines, when the chain is extended, are 22 yards asunder, and it has also been the practice to fix a projecting pin into each block, to which these lines are tangents. Now the length of the common Gunter's chain is reckoned from the inside of the handle at each extremity, therefore if one handle be dropped over the pin before described at one end of the local standard, it is obvious that the other handle should just be in contact with the pin at the other end of it.

L. 45. Mr. SIMMS.

The question as to the number of pieces of which the local standards for the sake of portability should consist, has been anticipated; but I will just further state, that 25 parts are convenient, inasmuch as they give the means of testing every fourth link of the Surveyor's chain.

L. 46. Mr. SIMMS.

With respect to mural standards in public buildings, it appears to me that if a stone of sufficient length were cemented into the wall, having two brass plugs fixed into it, by lead, plaster of Paris, or Roman cement, on which the length might be *set off* with a beam compass, and afterwards small holes drilled to a considerable depth, it would answer the purpose.

L. 47. Mr. SIMMS.

If the same plan were adopted for the comparison of Gunter's chain, it would not be necessary to unfold and refer to the local standard on every trivial occasion. Captain Dawson has two such plugs in a parapet at Somerset House, and I have also similar ones fitted into the pavement adjoining my own premises.

L. 48. Mr. WADE.

With reference to the Exchequer and County standards, I think the yard measure ought to be subdivided into the half, the quarter, the half-quarter, and the nail, as I have frequently had yard measures to stamp where the subdivisions vary $\frac{3}{8}$ ths of an inch; and when I have refused to stamp them, the person has told me he could get them stamped at the City or Middlesex offices, as they only looked to the extreme length being correct. I have frequently had one and two-foot rules brought me to stamp; therefore, if the yard standard was subdivided into feet, inches, halves, quarters, and eighths, it would answer both purposes.

L. 49. Mr. WADE.

With respect to the 112 lbs. weight, I think the Exchequer ought to have a 112 lb. standard, and every County Inspector should be provided with two 56 lb. standards to compare the 112 lb. weights with; and that part of the 21st clause which states that no weight above 56 lbs. is to be inspected or stamped, should be struck out, as I have seized weights that have been used for buying in merchandise weighing nearly 60 lbs., and several coal-merchants in my district where I have seized their 56 lb. weights for being light, have now got 112 lb. weights, which under the 21st clause I cannot inspect.

L. 50. Mr. WADE.

As relates to the wearings of the County standards, I took mine to the Exchequer, March 26th, 1840, and found the deficiency as under:—the 56 lbs. 14 grains; 28 lbs. 18 grains; 14 lbs. 3 grains; 7 lbs. 6 grains; 4 lbs. 3 grains; 2 lbs. 5 grains; 1 lb. 2 grains; $\frac{1}{2}$ lb. 1 grain; $\frac{1}{4}$ lb. bare 1 grain; 2 ozs. $\frac{1}{2}$ grain; the 1 oz., $\frac{1}{2}$ oz., $\frac{1}{4}$ oz., 2 drachms, 1 drachm, and $\frac{1}{2}$ drachm, the least turn of the scale; the quart, pint, $\frac{1}{2}$ pint, gill, and $\frac{1}{2}$ gill, were quite correct, the whole of them being in use 1 year and 9 months, during which time I have compared and stamped 87,277 weights and measures, of which the majority is from the quart to the $\frac{1}{2}$ gill.

L. 51. Mr. WADE.

I think it advisable that there should be a clause introduced to enforce the county or local standards to be compared with the Exchequer standards at stated periods; there is certainly a great difference in the wearings of different standards, but I think the medium time would be, the weights not to exceed three years, and the measures not to exceed six years.

L. 52. Mr. WADE.

With respect to the metal of which the local standards should be composed, I have had some experience in machinery, and have found gun-metal to be the most durable, therefore I should decidedly recommend gun-metal, as it will bear more friction than yellow brass.

L. 53. Mr. WADE.

As relates to the shape of the standard measures, the present shape of the bushel and half-bushel is very awkward, they would be much more convenient if they were all the same depth and diameter, as near as possible, inside measure.

L. 54. Messrs. WARNER.

We consider it absolutely necessary, that all county and local standards should be compared at stated periods, say for measures every 5 years, and weights every 3 years, with the Exchequer standards, and unless this is enforced by Act of Parliament *under penalty*, or by non-compliance, *such to be illegal to convict by*, there will be no security for correct weights and measures as standards in after years, there having always been a great neglect in this particular. Previous to the late Acts, it was a very uncommon circumstance for any county or local standards to be re-examined by the Exchequer standards. In fact, few had been there since they were first issued, perhaps a period of from 50 to 150 years, but had been repaired by the tinman or smith in the place without being reverified by the Exchequer standard, and as might be expected, it was impossible to find two county or local sets that would agree; and in case of dispute, if a tradesman's weight was found deficient by the standard of one town, in all probability it would be over-weight by the standard of the next town. The county or local scales should also be sent at stated times for examination, for if they are allowed to rust or become imperfect, it must be useless to have regulations made for the correctness of weights.

L. 55. Messrs. WARNER.

The only evasion (we know not whether it can be called a fraud) of the present system, is the introduction of 112 lb. weights in some instances, and in one case it was, we were informed, adopted expressly to escape examination, the parties having previously had a large quantity of 56 lbs. seized as incorrect, and were determined they should not be compared again, and therefore replaced them with larger weights than either the Inspectors or Inquest possessed.

L. 56. Messrs. WARNER.

The probable inaccuracy in a set of local standards, after having been in use for some years and moderate care taken of them, would, on an average of sets, be found as under, the measures almost as frequently being found to exceed the required quantity as deficient of it, while the weights would invariably be found deficient. The increase in the contents of the measures is supposed to arise from bruises, it being the general custom to put one in the other when conveyed from place to place or using them in the markets, and not unfrequently the 56 lb. weight inside.

Bushel.	$\frac{1}{2}$ Bushel.	Peck.	Gallon.	$\frac{1}{2}$ Gallon.	Quart.	Pint.	$\frac{1}{2}$ Pint.	Gill.	$\frac{1}{2}$ Gill.
7 to 10 or 20 cubic inches.	7 to 12	12	9	2	1	1	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$
56 avoird.	28 lbs.	14 lbs.	7 lbs.	4 lbs.	2 lbs.	1 lb.	8 oz.	4 oz.	2 oz.
$\frac{1}{4}$ to $\frac{1}{2}$ oz.	$\frac{1}{4}$ to 1 oz.	$\frac{1}{2}$ oz.	$\frac{1}{4}$ oz.	2 drachms.	1 drachm.	1 drachm.			

[The following Extract was inadvertently omitted in its proper place.]

L. 42.*—Sardinian Laws.

§ 18. Every five years the standard-men shall transmit to the Inspector their standards, for the verification of the same.

J. D. Moore, W. A. Moore

The purpose of this instrument is to set out the standards for the measurement of the weight of the various articles of commerce, and to provide for the enforcement of the same. It is intended that the standards shall be such as to be uniform throughout the State, and that they shall be such as to be fair and reasonable to all parties concerned.

TABLE OF STANDARDS

Article	Standard	Weight
Wheat	1 bushel	60 lbs.
Barley	1 bushel	56 lbs.
Oats	1 bushel	52 lbs.
Rye	1 bushel	56 lbs.
Corn	1 bushel	56 lbs.
Sorghum	1 bushel	56 lbs.
Beans	1 bushel	62 lbs.
Peas	1 bushel	60 lbs.
Lentils	1 bushel	60 lbs.
Flour	1 bushel	60 lbs.
Meal	1 bushel	60 lbs.
Grain	1 bushel	60 lbs.

It is the duty of the State to see that the standards are such as to be uniform throughout the State, and that they shall be such as to be fair and reasonable to all parties concerned. It is the duty of the State to see that the standards are such as to be uniform throughout the State, and that they shall be such as to be fair and reasonable to all parties concerned.

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SECTION M.

EXTRACTS RELATING TO THE STATE OF THE LAWS APPLYING TO THE POWERS AND DUTIES
OF INSPECTORS OF WEIGHTS AND MEASURES.

M. 1. Mr. CHILD.

The suggestions I would beg to offer as to the mode of comparing tradesmen's weights and measures, are as follows:—First, I would abolish all *arbitrary and irresponsible* authorities, for while they are oppressive to the honest tradesman, they often prove a means of escape to the guilty; also the powers vested in various parish authorities for stamping, &c.; for while such a diversity of authorities annoys unnecessarily the tradesman, it also prevents that uniformity which is so highly desirable and important.

M. 2. Mr. CHILD.

It is also requisite that the Act should be so framed, that each Inspector should by his appointment have power to enter any and *every* shop, store, &c., to examine and test any *weight, measure, scale, beam, or other balance*; and if found illegal, or unjust, then to seize the same, and bring the parties so offending before the magistrates, together with the false weights, &c. &c.; and if then proved to be illegal or unjust, the same to be forfeited, &c., the parties so offending to be fined according to the circumstances, and pay the costs and expenses attendant on such removal and examination.

M. 3. Mr. CHILD.

In consequence of a magistrate having dismissed some cases of false weights which had been seized by Mr. Child under a *general* order, the Bench of Magistrates for Middlesex lately moved the Court of Queen's Bench to grant a *mandamus* requiring the magistrate to hear the cases, which was granted: thus apparently establishing the validity of *general* orders. It seems nevertheless desirable that all doubt should be removed. And it seems very desirable that more decisive power should be given to seize unjust weighing machines.

M. 4. Mr. CHILD.

The Inspector should also have power to enforce the stamping and reverifying all weights and measures in his district at stated periods, say once in every year.

M. 5. Mr. DE GRAVE.

I am convinced that the greatest protection the public can have from being cheated by false scales, weights, and measures, is Inspectors, who ought to receive power from the magistrates to visit at any reasonable time (not at stated periods), any shop, &c., where either scales, weights, or measures are used. But those Inspectors *ought not* to have the power of seizing either scales, weights, or measures, unless it is evident that fraud is intended, especially as it regards *weights*; a weight may be a shade deficient, and that only from the fair wear of a few months; surely

M. 5. Mr. DE GRAVE—*continued*.

Inspectors ought not to have the power to seize weights of this description. I have known instances where Inspectors have acted exceedingly bad to most respectable shopkeepers, persons who would have shuddered at the thought of having light weights in their possession, and have been taken before a magistrate for what they could not help.

M. 6. Mr. GINGELL.

Security to commerce, and good will to the community, cannot be carried into effect generally by the provisions of the 5 and 6 Wm. IV., cap. 63; the conflicting opinions of the most eminent counsel upon its general bearings are extraordinary: Sir W. Follett and Sir John Campbell are completely opposed to each other, particularly as regards the *general authority* to Inspectors by the magistrates; the one contending it is legal, the other that it is illegal in direct terms.

M. 7. Mr. GINGELL.

Since the publication of the last edition of "Chitty's Burn's Justice" with the remarks of Sir Wm. Follett and the learned editor, the statute 5th and 6th Wm. IV., cap. 63, has become inoperative.

Armed in case of need to pounce upon an offender before he could escape, the Inspector ought to have the power instanter to seize any weight, measure, or weighing machine, in any house, shop, store, yard, or place, cart, stall, or basket, in the public streets, and in any ship or vessel in port or dock. As an example, the Inspector sees a hawker of meat, fish, fruit, vegetables, &c. (of these there are hundreds daily in Bristol), selling to the public by short or unstamped weights or measures, or a false balance: he cannot examine them without a *special warrant in every case*; 1st, A difficulty presents itself in obtaining the christian and surname of the offender, as hawking provisions without a licence is legal, and you cannot compel him to tell you his name. 2nd, An application to a magistrate for a warrant to search, may occupy two or three hours. 3rd, When you return to the street where you left the offender, he has sold the contents of his cart, made a good hit, laughs at the law, and is gone. Now if the Inspector had always in his pocket a *General Authority*, he could prevent the public from being thus cheated, and arrest the offender in his career.

M. 8. Mr. GINGELL.

Several Inspectors-General should be appointed, having a jurisdiction of several counties or cities, according to the extent of the population, whose business it should be to see that the provisions of the statute be carried out by some uniform system, with that degree of accuracy intended by the legislature, by making a general survey once in every month at least, over the whole of his district; to visit each individual Inspector at his station; to see that he is competent to his duties; to examine the state of his standards, the state of his stamps and brands, his mode of registry, the accuracy of his accounts, &c. &c.; to report his general conduct and ability at each respective quarter-sessions of the county to which such Inspector may belong.

The 24th section of the 5 and 6 Wm. IV., cap. 63, directs that the Inspector shall keep an account in writing of all weights and measures which he may stamp, but it does not give a general system; a register ought to be a general and uniform one.

(A specimen of a proposed register was sent by Mr. Gingell.)

M. 9. Mr. GINGELL.

Fixed penalties in all cases would be desirable; it often relieves magistrates of a feeling of embarrassment in particular cases; this would secure the Inspector from loss, and the public would be protected against fraud in county districts; he cannot do his duty unless he visits every person who sells by weight or measure, to examine them, within his district; in so doing

M. 9. Mr. GINGELL—*continued.*

he is at a great expense, by having horses, carts, and attendants for the purpose of examining and seizing; the weight of his standards is about 8 cwt., and this forms one load; should he be an efficient officer he may in one day seize a cart-load of defective weights and measures.

The parties are summoned to appear at some petty sessions; a difference of opinion arises with the magistrates as to the construction of the statute, and will give the benefit to the accused; other magistrates, from a desire to court false popularity at the expense of the public, will award a trifling penalty, in some cases not more than one shilling. Here the Inspector is in the power of the magistrates, who may direct a twelfth part of such shilling to be given to the Informer; thus an Inspector, who has expended 5*l.* out of his own pocket for travelling and other expenses, may obtain 5*s.* in return.

The penalty ought to be fixed; the Inspector is the nominal informer and witness; the business cannot be brought forward and supported without him; a proportion of such penalty must be awarded to him not exceeding a moiety.

The duty of examining and seizing by warrant is one not of choice, but of necessity, attended by great personal risk and odium, and requires more than ordinary nerve, and he very naturally expects an extra remuneration for such services.

M. 10. Mr. GINGELL.

The Inspectors of the City of London, by a local Act, have the power to examine any measure, and seize and break any found defective.

M. 11. Mr. GINGELL.

Should troy weight continue, it ought to be subject to the same control and examination as *avoirdupois*; and indeed more strictly so, because the commodity sold by it is of the most valuable nature—the “precious metals.” It is to be regretted the Legislature did not embrace so important a subject. These dealers are not subject to any control; no authorized agent or officer appointed to examine them; they are at full liberty to adjust their scales and weights to their own false standard; and this is done to a great extent in London and other large towns, by pawnbrokers, refiners, and silversmiths, at the expense of the middling and needy classes of society. An Inspector ought to be appointed in each city and county to attend this class of persons; the gain is immense upon a trifling defect in either weights or scales.

M. 12. GLASGOW COMMITTEE.

It appears to them that it ought to be declared competent for any person to inform and prosecute for the penalties applicable to the use or possession of improper weights and measures, and be entitled to a share of the penalty. This is no uncommon proviso in regard to penalties, and in the present case its operation would not prove objectionable. It would chiefly operate by its moral influence, and promises greater efficiency, while it would create less expense, than the appointment of Inspectors, &c. to make periodical visits, as provided by some of the statutes incorporated with the Bill.

M. 13. GLASGOW COMMITTEE.

The latter part of that clause confers on every individual, a discretionary power of causing the custodiers of standards to travel to any quarter of their respective districts, for the purpose of there exhibiting the standards. This latitude appears too great. Would it not be enough, that reference concerning weights, &c. might be had to the standards in each county, at the places appointed for their custody, unless otherwise directed by a judge or magistrate?

M. 14. Mr. HAYMAN.

Remarks on the Act now in force :—

Clause 23.—This clause seems to me extremely improper, and tends to exclude persons who have practical knowledge of weights and measures, and to commit the duties of examination to persons who know nothing of the subject.

Clause 26.—It is somewhat curious that by this clause weight-masters in Ireland are to compare their copies of standards once every 5 years, by a set of copies once verified at the Exchequer ; but the latter may be used time immemorial without reverification.

Clause 28.—This clause was, I presume, intended for carrying the Act into effect, but it is far too limited ; magistrates are empowered to authorize an Inspector to enter *any* shop, store, &c., but not to give a general order to enter *all* shops, stores, &c. Consequently all the appointments of Inspectors made at the passing of this Act fall to the ground, and after great preparation had been made to carry out the Act, by going round it was found out there was no power under the Act, and therefore all these Inspectors have dwindled down to mere stampers of such weights and measures as may be brought to them, a duty which could very well have been done without their aid ; and it is clear, from the words “ *wherein* goods shall be exposed, &c.,” that an Inspector may not examine any of the numerous weights and measures used out of doors (say in the streets), and thus the fair trader is undersold by persons who pay little or no rent, and injured by the most unprincipled persons, whose weights and measures are subject to no inspection whatever, but which are notoriously defective. Most of the Acts have been silent upon this point, but much good would result if this was altered. Jurymen and Inspectors could then examine coals and other goods whilst in the act of delivery.

M. 15. Mr. HAYMAN.

I think the Legislature would do well to abolish rather than protect the rights of different corporate bodies, or at least to put them under proper control—I mean of course as it regards weights and measures. The Committee will have seen what I have already stated [below] as to the manner of calling on shopkeepers and inspecting weights and measures by parochial and other authorities who possess that right, either from some charter, custom, or local Act. I feel quite confident, from the manner I have always seen these duties done, that anything but the real object is kept in view ; on the contrary, the parties called on to act either wholly neglect their duty, as in the case of some parishes [named in Mr. Hayman's communication], or perform it in a most disgracefully rigid manner, as in the case of other parishes [specified by Mr. Hayman]. If this part of the subject comes within the proper cognizance of the Committee, they will find what I have stated fully borne out ; and I think the Committee will concede to me the point that all the duties of comparing weights and measures at the time of stamping, as well as of inspecting them afterwards, and of administering the laws generally, should be done and performed in precisely the same manner ; and that the interests of the public demand that the persons exercising local rights should nevertheless be made to act in strict accordance with the several Acts that may from time to time pass the Legislature, otherwise very great injustice must ensue.

M. 16. Mr. HAYMAN.

Until I introduced an easy and correct method of comparing wooden measures, they were never compared at all, but stamped without any proof, not only in London and Westminster, but in most parts of the country ; and when I was at the several committees upon it, I produced many measures duly stamped, but varying from each other from 1 to 2 quarts in the bushel. I have some of them by me now ; in Middlesex a number of Inspectors were appointed to

M. 16. Mr. HAYMAN—*continued*.

compare and stamp, but partly through the want of competency, and partly through the extreme hurry, the work was most imperfectly done, and nearly all the inhabitants were laid open to the penalties of the Act, but fortunately those penalties could not be enforced by reason of there being no power given in the Act to the Inspectors to go round. I have seen measures stamped in Middlesex as imperial measures, when in fact they were Winchester, and contained nearly $5\frac{1}{2}$ pints in the bushel too little, and many $\frac{1}{2}$ hundred-weights were stamped and afterwards found to be 3 and 4 oz. in error. But to be as brief as I can on this point, I will refer to another stamping office [named by Mr. Hayman]; there the Inspector holds his office under the Court of Burgesses, and he was appointed to his office being *blind*; he however nominates a deputy, and that deputy has attended his duties for many years on Tuesday and Friday, from 11 till 3—for proof of this see the hours named on the office door—to do what? why for many years to stamp more weights and measures than any other office in the kingdom (the fees of that office being the lowest). Will the Committee credit me when I say (and I am fully prepared to prove it by all the trade), that the system at this office has for many years been to stamp all weights and measures indiscriminately, whether right or wrong, without any comparison whatever with the standards, and I venture to say at this moment that both London and the country are inundated with weights and measures bearing the stamp of that office, which have not been compared with standards, and which of necessity subject the parties who hold them to the penalties of the Act. Need I say that all the erroneous weights and measures rejected at other stamping offices are sent to that office and there stamped, and that a journeyman, knowing no comparison takes place, never thinks of making them correct, when intended to be stamped at this office. There is a penalty in the late Act, section 29, to enforce a proper comparison at the time of stamping, but that refers to persons only appointed under the authority of that Act, and not to London, Westminster, or other parts possessing chartered or local rights.

M. 17. Mr. HAYMAN.

It was no doubt intended by the late Act, section 28, that Inspectors should perform the duty of going round to inspect the accuracy of weights and measures, and to detect frauds; but that power seems, by the section to which I have referred, to be confined to magistrates, who it would appear do not perform the duty, and therefore nothing is done under this Act, at least not that I am aware; but still there are a number of persons having this right, and it is to their proceedings I wish to refer. I have already referred to one place, and have endeavoured to point out the manner in which they do the work of stamping. I will now state how they act with regard to inspecting;—the Court of Burgesses swear in 36 jurymen to go round the city and liberties every 14 days, and then a comparison takes place with the standards, and all that are found not to correspond are seized, and the parties not only fined but grievously exposed and injured in their business. First, the stamper stamps all the weights and measures without comparison with the standards or other proof of their accuracy; the same man then accompanies the jury, and for the first time makes the comparison, and seizes the very weights and measures he himself has stamped in error. When the Court meet to hear appeals, the chairman who presides takes half the penalty, and the subordinate officers the other half, and the Court is closed against any further appeal, and no professional gentleman may defend any suit in this Court. I have made several attempts to correct some of these irregularities, and I so far succeeded about 12 months ago as to compel them (the jury aiding my efforts), to reverify their standards, which had been 10 or 12 years in use without examination; and there has been since that time some little improvement in the manner of their performing their duties, but they are but very partially reformed, and vast quantities of weights and measures are still stamped

M. 17. Mr. HAYMAN—*continued.*

without comparison, and much irregularity still exists. I mention this case more particularly, to shew that the Legislature, in protecting the rights of certain privileged places, are inflicting a serious injury in many cases. I have no doubt whatever that if the Committee inquire, they will find that in all such places some very bad custom exists. I would, for instance, mention another [named by Mr. Hayman]; here the parish beadle comes round accompanied by three or four persons who say they act under a precept from the Lord of the Manor; however, they have no legal standards (those they have never having been verified at the Exchequer,) and they never detect any fraud, or inaccuracies in weights and measures; in fact, like most others who act under the same authority, they have quite another object in view, they just take a glance at the weights and measures, and then hold out a bag in which the shopkeeper is expected to put either 6*d.* or 1*s.*, and this being done, any fraud is passed by, and a purse is thus annually made up, of course to answer some long and established custom; they know the number of persons to be called on, and they of course calculate upon the sum of money to be produced. I know this custom exists in many places, and although it is comparatively very harmless, yet I doubt if such rights are worth protecting unless the duties they pretend to perform were really attended to. I know other places, however, I will name one [specified by Mr. Hayman,] where a larger sum of money seems to be wanted, probably to pay some permanent officers, and here the duty (although as in the last case acting under a precept from the Lord of the Manor) is very differently performed; in this parish it seems the 6*d.* or 1*s.* paid in that last mentioned to neglect the duty will not suffice, in this case fines must be enforced under circumstances the most absurd. I recollect a short time ago the jury went into a butcher's who had just been selling some salt meat, and because his scale-beam, which was wooden, had a turn, and that against himself, of the weight of 1*s.*, it was seized and taken in front of the house and broken up in the presence of a number of persons passing. When, however, the gentlemen met after their day's labour, they thought this rather too bad, and returned the scales without inflicting any penalty; an opposite neighbour, however, was not quite so lucky; he (an oilman) had a pound weight seized because it was rather too heavy, and fearing lest his other pound weight should share the same fate, he rubbed it in the presence of the jury, and then that turned out a little too light, and therefore both were seized and a double penalty inflicted. I happen to know that this oilman employs a respectable scale-maker to adjust his weights and scales every six weeks, and that the deviations complained of arose from causes which no human power could prevent; the Committee will find that wherever the penalties fall into the hands of the parties going round, these malpractices are sure to exist. I think this difficulty might be met by a reasonable allowance being made for deviations caused either from the effects of the atmospheric air, or from the particular tendency of certain articles with which weights and measures have to come in contact. It is quite certain perfect accuracy never can be preserved, hardly in the standards, much less in weights and measures intended for ordinary use. I have sometimes thought if the Inspectors for the county were to accompany these parochial authorities, much injustice might be prevented, because they are paid by a salary, and are more conversant with the subject. In some parishes [named] the Lord of the Manor declines to act, and the County Inspector having no jurisdiction, a system of wholesale fraud prevails.

M. 18. *Prussian Laws.*

§ 3. In each department there shall be formed a commission for stamping weights and measures (Eichungs-commission) subordinate to the Departmental Government, consisting of a director named by the Departmental Government, four to six unpaid assessors (Beisitzern), chosen

M. 18. *Prussian Laws—continued.*

by the municipal authorities (Stadtverordneten des Orts), from the inhabitants (Bürgerschaft), and a mechanic, appointed by the Government on the nomination of the commission.

§ 4. The commission established at Berlin is also bound, as often as required, to examine the standards of the other commissions, and to direct the construction of standards, for the accuracy of which it will be responsible, on assurance of indemnity for the expenses. The place of sitting of each commission in the departments shall be determined by the Minister of Finance, &c.

§ 5. Every commission has a set of standards. It is bound to assure itself of the continued agreement of its standards with those of the Berlin commission, by comparison and repair when needed, as often as is necessary, and at least once in every five years. The papers relating to this [comparison] shall be preserved in the department.

§ 6. Under the inspection of the commissions, offices for stamping weights and measures shall be erected in the most important commercial towns. For the present, the places shall be determined by the Office of Finance, &c. on the petition of the Departmental Government.

§ 7. The stamping offices consist, like the communal institutes, of a member of the town council (Magistrats-Mitgliede), two to four deputies of the inhabitants (Bürgerschaft), and one professional man (Sachkundigen). They receive from the commune one set of standards made after the set of the commission, section 5, whose agreement with the set of the commission is to be tried at least every three years, and to be attested by the commission in order to receive legal value (zu ihrer Legitimation).

§ 9. It is the duty of the stamping offices to test the exactness of the measures and weights brought before it by the proper public authorities (öffentlichen Behörden), and by private persons; and if desired, to attest it by impress of the stamp intrusted to them. The stamping commissions also have the same duty, and are in all respects to exercise the functions of a stamping office, particularly for their own locality.

§ 13. All public offices, as post-, military-, and civil magazines, for the computation of running accounts with the state or the commune, offices of woods and works, &c. and all which are constituted for public confidence in measures and weights, as land-surveyors, wood-surveyors, corn-meters, managers of public scales (weigh-bridges?), &c., are bound, in the discharge of their offices, to make use of none but properly stamped measures and weights; and must not suffer any unstamped measure or weight in their place of business, under a fine (Ordnungs-Strafe) of five thalers.

§ 14. Every public assembly of a circle or state (kreis- und städtische Polizeibehörde) must have at hand stamped measures and weights, as far as is necessary in that locality, for making proper inquiry into the infractions of the law in ordinary commerce.

§ 19. The local police is bound frequently to examine the measures and weights with which sales are publicly made. For those which are found unstamped, it summarily exacts, by virtue of a decree (mittelst Dekrets), the fine named in section 12. Stamped measures, &c. which it finds not in agreement with its standard measures, &c., it sends for examination and correction, according to section 9, to the nearest stamping office. The expenses of carriage and stamping fall upon the owner. If there is in either case suspicion of fraudulent design, the police also reports the case to the criminal courts, which are to examine it by virtue of their office, and to decide (erkennen) thereon according to the laws.

§ 31. The stamping commissions shall have for sale brandy-standard measures, which must be made according to the normal measures which the commissions are to receive, and must be stamped by them. Any one who eight months after the publication of these laws, buys brandy

M. 18. *Prussian Laws—continued.*

in large quantities (im grössen) of a stipulated strength, may require that it be delivered to him by such stamped standard measures.

§ 34. The stamping commission at Berlin is specially charged to have ready for sale, carefully constructed standards of measure and weight for the purposes of scientific inquiries.

§ 35. All stamping commissions and stamping offices are to receive a tariff (taxe), in which the sums are fixed that they are to receive for the instruments connected with their official labours, and by them to be delivered (für die bei ihren vorfallenden Arbeiten und von ihnen zu liefernden Werkzeuge). This tariff must be affixed in their office to the public view of every one, must be communicated to the assembled police bodies, and must also be generally made known by public papers.

We specially charge our office of finance and commerce with the carrying out of this ordinance relative to measures and weights, and command the various authorities (unsern Ministerien, Landeskollegien, polizei- und justiz-Behörden, den Magisträten, Kommunen), and especially all the inhabitants of our states, carefully to observe it, each in his degree.

Berlin, 16 May, 1840.

FREDERICK WILHELM.

(Countersigned by 6 ministers.)

M. 19. Mr. REEVES.

Tradesmen's Weights and Measures are tested as follows :—

By poise, and counterpoise, in cases of weights being under examination. By measuring the contents of the copy of the standard, with rape-seed, through a hopper, and comparing with it the measure under examination, in cases of wooden measures. In the comparison of metal measures, water is used. Observation :—The seed is used on account of the wooden measure seldom or ever being in a state to hold water during the time occupied in testing, and because, after the use of water, a considerable alteration in the size of the measure takes place when dry, although no care can prevent the variation of the wooden measure from the effect of dry and wet seasons.

In the large weights, an allowance of a quarter of an ounce inaccuracy might be tolerated, without subjecting the owners to the penalties for false weights. The weighing beam should be strictly true.

In the new weight, Inspectors generally allow a surplus of a quarter of an ounce in the 56 lbs. weight, and in proportion to the decrease of denomination, a decrease of over weight ; so that in the smaller weights (say from the 7 lbs. down), the error allowed is a mere turn of a very finely turning beam.

The amount of error named above, would arise from fair wear and tear. The length of time in which such inaccuracy would occur, depends upon the business in which the weights are used, and may probably vary from six weeks, to as many months.

M. 20. Mr. REEVES.

By the Act of 5 and 6 Wm. IV. cap. 63, it was the intention of the Legislature to authorize Inspectors appointed by Justices of the Peace, to enter the premises of all persons in their respective districts, using or possessing weighing beams, weights or measures, for the purpose of business, and there to examine the same with the copies of the imperial standards ; this power is nullified by the provision that the Inspector must have the written authority of the justices to make such inspection, under which Sir William Follett and the Attorney-General have given their opinions that no Inspector can act with safety. So necessary is it to the furtherance of

M. 20. Mr. REEVES—*continued*.

public justice that Inspectors should have sufficient authority by virtue of their appointments, that it is to be hoped such power will be given these officers in any new enactment relative to weights and measures.

M. 21. Mr. REEVES.

The great end of any enactment for the better regulation of weights and measures, &c., will be frustrated, unless proper officers are empowered to fully carry out its provisions, for the want of which power, by an over-cautiousness in framing the clause by which it was intended to be vested, the Inspectors of Weights and Measures are limited to attendance at their offices, for stamping such weights, &c., as persons may think proper to bring to them for examination; the consequence is, the new work is all they have to do with, and after having been stamped, persons so disposed have the opportunity of altering their weights, without fear of detection, provided they are on friendly terms with the leet juries.

M. 22. Mr. REEVES.

By the 25th section of the amended Act (5 and 6 Wm. IV. cap. 63), the local authorities are revived, limiting the stamp to the local jurisdiction, but by the 27th section, no weight or measure stamped by any Inspector appointed under the authority of the repealed Act, or this Act, shall be liable to be restamped, although used in any other place than where the same was originally stamped, and is to be considered legal throughout the United Kingdom, as far as the stamping is concerned. Hence arises the confusion. Parish juries, in defiance of the provisionary clause, insist upon the parish stamp being put upon all weights and measures in use in those parishes which under local Acts have the right of stamping. In this county St. Marylebone has this right by a clause in the local Act of 35 Geo. III. chapter 73; St. Pancras under local Act of 59 Geo. III. cap. 39; there are consequently three different stamps in the county, besides those of the cities of London and Westminster. The manufacturer is either put to the inconvenience of sending to the local offices, or, as is the case especially with the metal measure makers, sends to the city offices, letting his customer chance an escape of being visited by the jury, or of defending his privilege under the 27th section, or of submitting to have his weights or measures restamped.

Were the county stamp for the county, or the city for the city, in which the weights or measures are used, or intended to be used, the only legal stamps, all would be simplified, and no such annoyance could exist.

M. 23. Mr. REEVES.

This appears a proper place to state the objections to the existing system of examination of tradesmen's weights, measures, weighing beams, &c., by leet juries; and to suggest a remedy for a vexatious mockery of public justice, which has long been universally complained of. These juries differ altogether from the juries of courts of justice.

A certain number of persons are annually chosen by court leets of hundreds, manors, &c., from the tradesmen of the division or district; and as all are in turn liable to serve, no regard is paid to the fitness of persons chosen, consequently, it almost always happens that many of the jury are, from their professions, unacquainted with the nature of the duty they are called upon to perform. One instance out of thousands will serve to prove this fact: a leet juryman, when asked how he judged of the accuracy of weighing beams, and what was his mode of examination, answered, "I take care both scales are quite empty and clean, and see whether or not they balance." This gentleman had never had a pair of scales in his hand before becoming a

M. 23. Mr. REEVES—*continued.*

leet juryman; to him the long and the short arm, the shifting pin, &c., were a mystery, and he was greatly surprised, when told that the beam used by the jury could be subject to error, nor had he the most vague notion how such error could be proved. In truth, these gentlemen, when understanding counterpoise, seldom trouble themselves to prove their beams before proceeding to examination. A greater evil than the incompetency of the jury, arises from the impossibility to an objection being taken to any individual juryman by the tradesman whose weighing apparatus is about to be examined; so that if he knows one or more of the jury are opposed to him in business, he must submit to the prejudice existing in the minds of his judges against him. On the other hand, friends, club-associates, and so forth, are subjected to a mere formal call; and many, very many instances occur, where the jury express themselves satisfied by a mere glance at the weights, &c., without trying the correctness of any. Of the powers vested in these bodies, one especially reserved by the 45th section is most arbitrary and monstrous; it is the right of leet jurors to break-up and destroy the balances, &c. seized for inaccuracy. Surely nothing can be further from justice than the use of such power, as it deprives the accused of all redress, in the event of the jury being in error; all evidence being destroyed, there can be no appeal. If the Inspectors, understanding practically the variations of the weighing beam, and having a knowledge of the variety of means practised by fraudulent dealers to falsify it, had the powers intended to have been vested by the 28th section, without being restricted by the written orders, the appointment to the office being good and sufficient authority for carrying into effect examination of the weighing beams and scales, weights, measures, &c., in use in their respective districts, the whole machinery would be simplified, and a nearer approach made to securing the public against the practices of fraudulent tradesmen, and would afford protection to tradesmen against prejudice and ignorance, the Inspectors being answerable for all acts done by them, and liable to severe penalties in cases of neglect or misconduct.

M. 24. Mr. REYNOLDS.

Shortly after the passing of this Act, I applied to R. E. Broughton, Esq., one of Her Majesty's Justices of the Peace, for an order (under the 28th clause of this Act) in writing, authorizing, &c. &c., which order I acted upon for a few days, during which time I made some extensive seizures, and summoned the parties before the magistrates. One of the magistrates present gave it as his opinion that *no magistrate had the power* of giving an order to the Inspector to enter *any* shop, store, &c.; it must be a special order for each individual, upon information. I saw, from the numerous frauds I had detected in the *few days*, the importance of the inspection, and I therefore took the opinion of the Attorney-General, who gave his opinion that I must have special orders. Thus the whole of the effect contemplated by the Act of Parliament fell to the ground.

My opinion is, that every appointed Inspector should have the power to enter any shop, &c., in the day-time, without any order, and examine and seize all unstamped or illegal weights and measures.

M. 25. *Sardinian Laws.*

§ 9. There shall be in every province a standard-man or verifier, named and approved with the patent of the Magistracy of the Royal Chamber; a previous examination being required before the Inspector of Weights and Measures, and other persons deputed by the Magistracy.

Candidates for this office are to give proof of their acquaintance with the metrical system, as well as with the local weights and measures.

§ 10. The verifiers or standard-men are to exercise their duties in all the towns and countries of the provinces for which they are named.

M. 25. *Sardinian Laws—continued.*

As soon as they have received the patent of approval, they are to present to the Intendants of these Provinces, a memorial for the publication of the same, with indication of the times at which they shall go to the various districts (Mandamenti) for the annual examination of weights and measures hereafter directed.

§ 11. For the city and province of Turin, the duties of verifier or standard-man shall continue to be discharged by the Inspector of Weights and Measures. He may however avail himself of the services of two assistants (commessi o preposti), who ought to be approved by the Chamber of Finances: the examination prescribed in Art. 9 for standard-men having previously been passed.

§ 12. The standard-men shall verify the weights and measures which shall be presented to them, as well by private persons and merchants as by the adjusters (aggiustatori) and makers; and when their regularity is recognized, shall put upon them their mark, in the form and manner which will be hereafter indicated.

The verifiers, finding in the course of examination any weight or measure inexact, shall indicate its defect by an inscription (per iscritto), in order that the fabricator or adjuster may repair it according to the rules of his art. The verification, however, of delicate scales, for gold and precious stones, and for the use of druggists, shall be reserved for the Inspector, and for those verifiers who shall receive in their patents a special authority to that effect.

§ 13. The standard-men are prohibited from constructing weights and measures; but they may construct the standards which are to serve for their own use and for that of the makers and adjusters, as well as the standards which are to be preserved in the archives of the chief towns of the provinces and in the archives of the Chamber, in conformity with Art. 1, or any which may be demanded by other cities or communes for preservation in their archives.

This prohibition shall also extend to the assistants of the Inspector, as being charged with the functions of sub-verifiers in the city and province of Turin.

§ 14. In like manner the standard-men are not permitted to adjust weights and measures, unless for the simple operation of bringing the weights and measures to their exact values; for which operations they are forbidden to receive any fee, all payments being supposed to be comprehended in that which is due for verification and sealing (bollo).

§ 15. The standards for the use of standard-men, and those which are to be preserved in the archives of the Chamber, and those of the chief towns of provinces, shall be verified and marked by the Inspector.

For standards to be used by the makers and adjusters, and for those which may be demanded by the towns and districts which are not chief towns of provinces, it will be sufficient that they be verified and marked by the standard-man of the province.

§ 16. The mark of the standard-man shall consist in the arms of the province or its chief town, the initial letter of the surname of the standard-man, and the figures of the date (millesimo).

The first verification and mark having been made, it will be sufficient in any succeeding verification to stamp the two last ciphers of the date of each year in which the verification shall be repeated. The standard-men shall deposit an impression of their mark in the archives of the chief towns of the provinces, as also in the archives of the Chamber of Finances; and they shall not be allowed to make any alteration in it.

§ 17. The mark of the Inspector shall consist in a crowned shield with the eagle in its middle, and in the figures of the date, in the manner before indicated; the size of this mark and the way of applying it may vary according to the nature of the weights and measures to which it is to be applied. The Inspector is to deposit the impression of this mark in the

M. 25. *Sardinian Laws—continued.*

archives of the Chamber, and at the office of the chief magistrate (*ufficio del vicariato*) of this town, and must never afterwards change its form.

§ 18. Every five years the standard-men shall transmit to the Inspector their standards, for the verification of the same.

§ 45. The standard-men are to keep a register (*un registro a matrice in carta libera*), in which shall be described with dates and ordinal numbers, the quality and quantity of the weights and measures verified and marked for each of the makers, adjusters, merchants, inn-keepers, and others, who are liable to the obligation of keeping up (*di far seguire*) the said verification and mark, as also their name and surname, and the mark of the fee which had been demanded for that operation.

On the same register shall also be described the declarations mentioned in Art. 41, to be made by persons who possess balances and steelyards fixed to walls, and others for heavy loads.

To both these classes the respective certificates (*bollette*) shall be forwarded by the standard-man, for each of which he may demand the fee of $2\frac{1}{2}$ centesimi.

§ 46. After the expiration of the fixed terms, officers will proceed from the governor's office (*vicariato*) in this city and territory (including the commune of Grugliasco), and in the other [territories] from the respective judges, with the assistance of the standard-man, whenever it is judged convenient, for the examination of weights and measures, to verify whether they are marked and accurate; and whenever the foregoing regulations are infringed by any one, he shall be immediately, in the course of usual process (*sulla risultanza del verbale di verificaione*), condemned to the payment of the fine incurred.

§ 47. For the allowance permitted in weights and measures of every kind, as well as for the fees due to the standard-men, makers, and adjusters, there shall be provisionally adopted the regulations of the tables annexed to the manifestos of the Chamber of Commerce of 28th June 1817, and 24th March 1819, which shall be republished and attached to this law.

The magistrature of the Chamber of Commerce, shall form and cause to be published as early as possible the tables of the allowance, and of the tax (*tazza*) for the metrical measures and weights, and for the measure and weights different from those of the province of Turin, and which it shall judge proper to be preserved; until such publication shall have taken place application shall be made of the aforesaid tables already published, according to the size and quality of each weight and measure.

§ 48. The standard-men, makers, and adjusters, who shall demand more than is expressed in the aforesaid tables, shall incur a fine of 50 to 100 lire, besides the restitution of the sum unjustly exacted; and may also according to circumstances be interdicted from the exercise of their art.

§ 50. Whoever shall forge the mark of the standard-men, or the Inspectors of Weights and Measures, shall incur the punishment of one to two years' imprisonment, besides the punishment for fraud as above.

M. 26. Mr. WADE.

Suggestions for the improvement of the Act now in force :—

Clause 21. And be it enacted, That in England the Justices of the Peace in General or Quarter Sessions assembled, and in Scotland the Justices of the Peace and Magistrates at a meeting called by the Sheriff, and in Ireland the Grand Jury of each county, county of a city, or county of a town, shall provide for the use of the Inspectors good and sufficient stamps for the stamping or sealing weights and measures used or to be used in each and every county, riding, or division, county of a city, or county of a town; which stamps so provided shall

M. 26. Mr. WADE—*continued*.

be taken to be the stamps for such county, riding, or division, county of a city, or county of a town; and that all weights and measures whatsoever, except as hereinafter excepted, which shall be used for buying and selling, or for the collecting of any tolls or duties, or for the making of any charges for the conveyance of any goods or merchandize, shall be examined and compared with one or more of the copies of the imperial standard weights and measures provided under the authority of this Act for the purpose of comparison by such Inspectors, who shall stamp in such manner as best to prevent fraud such weights and measures when so examined and compared, if found to correspond with the said copies; and the fees for such examination, comparison, and stamping, shall be according to the scale contained in the schedule to this Act annexed; and all persons who, after the passing of this Act, shall make any weights or measures other than those authorized by this Act, or shall sell, expose to sale, or use, any weights or measures which have not been so stamped as aforesaid, or which shall be found light or otherwise unjust, shall on conviction forfeit a sum not exceeding Five Pounds; and that any contract, bargain, or sale, made by any such weights or measures, shall be wholly null and void; and that all such light or unjust weights and measures so used shall be seized, forfeited, and condemned; provided always, that nothing herein contained shall extend to require any wooden or wicker measure used in the sale of lime or other articles of the like nature, or any glass, or earthenware jug, or drinking cup, though represented as containing the amount of any imperial measure, or of any multiple thereof, to be stamped; but any person buying by any vessel represented as containing the amount of any imperial measure, or of any multiple thereof, is hereby authorized to require the contents of such vessel to be ascertained by comparison with a stamped measure, such stamped measure to be found and provided by the person who shall use such wooden or wicker measure, glass, jug, or drinking cup, as aforesaid; and in case the person who shall use such last-mentioned measure or vessel, shall refuse to make such comparison, or if, upon such comparison being made, such wooden or wicker measure, glass, jug, or drinking-cup, shall be found to be deficient in quantity, the person who shall use the same shall, on conviction, be subject to the forfeitures and penalties hereinbefore imposed on any person using light or unjust weights and measures.

Clause 28. And be it enacted, That in England and Ireland it shall be lawful for every Justice of the Peace of any county, riding, or division, or of any city or town, and in Scotland for every Sheriff, Justice, or Magistrate, of any borough or town, or for any Inspector duly appointed, at all seasonable times to enter any shop, store, mill, warehouse, yard, vender's cart, carriage, stall, or standing-place whatsoever, within his jurisdiction, wherein goods shall be exposed or kept for sale, or shall be weighed for conveyance or carriage, and also to detain any person offering or exposing for sale any goods, wares, or merchandizes, in any highway or public thoroughfare, and there to search for, view, and examine, all weights, measures, steelyards, balances, or other weighing machines, and to compare and try the same with the copies of the imperial standard weights and measures required or authorized to be provided under this Act; and if upon such examination it shall appear that the said weights, measures, steelyards, balances, or other weighing machines, are light, incorrect, unequal, or otherwise unjust, the same shall be liable to be seized and forfeited, and the person or persons in whose possession the same shall be found shall, on conviction, forfeit a sum not exceeding Five Pounds, and any person who shall neglect or refuse to produce for such examination, when thereto required, all weights, measures, steelyards, balances, or other weighing machines, which shall be in his or her possession, or shall otherwise obstruct or hinder such examination, shall be liable to a like penalty.

M. 27. Mr. WADE.

With reference to the 27th clause, the public have not received any benefit from it; but, on the contrary, they have been imposed upon by having stamped measures sent them that have not been compared with the standards; therefore I think it would be judicious to strike it out.

M. 28. Mr. WADE.

There is another evil produced by the 27th clause, which allows other persons to stamp weights and measures than those appointed by the magistrates at Quarter Sessions, as there is an office [named by Mr. Wade] where thousands of weights and measures are stamped without ever being compared with the standard; but County Inspectors are under a penalty for stamping weights or measures, without first comparing them with the standards. (See 29th Clause.)

M. 29. Messrs. WARNER.

We consider the frequent inspection of tradesmen's weights and measures by the Inquest the only effectual plan to insure a correct and uniform system of weights and measures throughout the country. The scales or machines for weighing should be examined at the same time. All perquisites, such as offering the Inspectors a proportion of the fines, should be discontinued; which only ends in their laying unnecessary and often vexatious informations; instead of which every reasonable allowance should be made for fair wear, when there is no appearance of an attempt to defraud.

SECTION N.

EXTRACTS RELATING TO THE MANUFACTURE AND USE OF TRADESMEN'S
WEIGHTS AND MEASURES.

N. 1. Mr. BATE.

I believe tradesmen generally pay a quarterly or annual sum to scale-makers, who contract to keep their weights, measures, and scales in order, and to have the former two properly stamped by the local Inspectors.

N. 2. Mr. CHILD.

The variety of frauds I discovered, during the short period I held a magistrate's order to inspect, are numerous; one of which I may name, as I have a specimen that I retained, viz.—a set of pewter spirit measures with false bottoms.

N. 3. Mr. CHILD.

For all measures made of pewter, or other metals capable of containing liquids without absorption, the shape is of little consequence, as they are tested by water, undoubtedly the truest method where it can be adopted; but no wood measures should be allowed to be manufactured of various diameters and circumferences, nor of less measure than one quarter of a peck.

N. 4. Mr. CHILD.

As to the wear and tear of tradesmen's weights and measures, they vary considerably, according to the business; the fair dealer generally employs a scale-maker to examine them occasionally; and here I must observe, while the respectable scale-maker usually leaves them correct, the jobbing or itinerant trader often leaves them quite the reverse.

N. 5. Mr. CHILD.

If any weight or measure is proved to be altered after stamping, without (after a reasonable time) being brought for reverification, the parties so offending should be subject to a penalty.

N. 6. Mr. CHILD.

There should be no *iron* weight allowed under one pound: and no iron weight should have a cap of lead at the top and a plug at the bottom; in fact, it should have only one surface of lead, run perfect, neither cut away from or added thereto, and the surface as small as convenient to adjust the weight; then the Inspector would be enabled to do what he cannot under the present system, viz.—immediately to detect fraud.

N. 7. Mr. DE GRAVE.

Measures of different diameters are often used for the same purpose by different persons; this applies to fruit measures.

N. 8. Mr. DE GRAVE.

I think any enactment regarding the shape of weights used by the public would be both inconvenient and injudicious, and the only prohibited metal should be lead. Iron weights must be adjusted by lead, but only one place ought to be allowed for that lead; at present, iron weights are cast with more than one place for lead, consequently, the lead might be removed from one of the places, and still the weight would be to all appearance correct, and would not be detected unless it were tried.

N. 9. Mr. DE GRAVE.

The wear of weights varies very much according to the trade that uses them, also the situation, whether damp or dry, and time of year.

The weights of sugar-bakers, wholesale grocers, oilmen, salt warehouses, and such like trades, get deficient very soon, so soon as to require fresh adjustment every three or four months.

N. 10. Mr. DE GRAVE.

All wholesale houses, docks, and large establishments, have their weights and scales attended to by scale and weight-makers periodically (four times a year), and so do respectable shopkeepers in or near London. In the country, shopkeepers frequently keep a set of standard weights to adjust what they have in common use, and, from my experience, I am of a decided opinion that the mass of tradesmen are most desirous of having correct scales, weights, and measures, and not at all deserving of the censure that is often cast on them.

N. 11. Mr. DE GRAVE.

I consider it would be a great improvement, not only for standard measures (*see* L. 19), but also that all wooden measures that are used by the public, should have a fixed diameter and depth, and that the diameter and depth should be the same. The same denomination of measure now varies considerably, and it would protect the public much, were one shape established. Measures used for liquids ought alone to be exempt, as spouts or lips to them are necessary.

N. 12. Mr. GINGELL.

I beg to forward to you a model of a weight, with the mode I have for years adopted (and, indeed, its use is now pretty general), that of a copper plug inserted and dovetailed into the iron weight, and a duplicate stamp applied in the cavity at the bottom of the weight, which is the only uniform mode to prevent fraud.

The copper plug is inserted thus in the side of the weight, because it is a conspicuous part for application of the legal stamp under the 5 and 6 William IV. The reasons for adopting it are—1st, That you cannot legibly stamp on cast-iron. 2nd, The copper plug will not corrode, thus the public may the more readily detect the unstamped. 3rd, When the weight has been verified by the Inspector, he applies his seal to the under or adjusting part of the weight, and it so covers the whole surface, that the weight cannot be altered without the knowledge of the owner. Should it, from corrosion or friction, become defective, it must be re-adjusted, and must be restamped, which restamping is to certify its genuine character.

N. 12. Mr. GINGELL—*continued.*

Since I have introduced this plan, it has been adopted by many iron-founders and weight-makers in the north.

The London-made weights are round, and have a cap of lead on the top, which cannot be covered with the legal stamp, so that parts may be cut out without defacing the original stamp, by any dishonest dealer; in fact, it offers a premium to fraud.

(A model of a weight, constructed in conformity with the description above, was transmitted to the Commission by Mr. Gingell.)

N. 13. Mr. GINGELL.

Remarks on the Act now in force :—

Section 12 enacts that all weights shall have their contents in legible figures or letters on the top or side, and that all measures shall have theirs stamped or marked on the *outside*. This is evaded by makers stamping the contents on the *bottom*, where it is not seen.

All old weights and measures, made before the passing of the 5th and 6th Wm. IV., c. 63, should have their contents painted or stamped on *their sides only*; and all measures made since the passing of the said Act should have their contents marked on the side only. All cased weights should be stamped "cased" on the top only.

Section 13. Respecting cased weights, these should be prohibited, being so open to fraud; for, by a person perforating a small hole with an awl in the bottom, and placing it over a fire, he may extract any quantity of lead from 1 oz. to 14 oz., leaving it a perfect skeleton, with all the stamps of authority on the surface. In each 1 lb. weight there are 14 oz. of lead in the brass case of 2 oz.

I am of opinion that advantages would result by a departure from the existing law, as regards the diameter of measures, so as to preserve uniformity of contents. By the 5th Geo. IV., c. 74, which repeals fifty-five other Acts, I presume it was the intention of the Legislature to have had one uniform weight and measure throughout the kingdom: yet, in the face of this very Act, the Chamberlains and Auditors of the Exchequer did verify and stamp several sets of weights and measures of different shapes and forms, for various corporations, whereby no uniformity of contents can be ascertained. I am practically convinced that, unless it is enacted that all measures used for dry goods (if they should be still continued), shall be of stated dimensions, there will be no uniformity of contents. For an example—in corn or seed, take a bushel of the original shape, 18½ inches diameter, and a modern one, of 15½ inches diameter; the former will, according to the skill of the filling operation, hold from ½ lb. to 2 lbs. more than the latter. The action of the circular strike over the larger surface, will also make a great difference, although this is counteracted in a degree by the gravity of the corn or seed falling into the depth of the smaller shape. I have invented a self-acting filler, which would give every measure equality of contents; but I fear it would never be in general use.

N. 14. Mr. GINGELL.

I propose that *all* and *every* vessel to contain any commodity or thing *for sale* shall have the diameter equal to the depth.

I advocate this system for its simplicity—"every man his own lawyer." The man of fashion tests his cup or glass with his *pencil-case* or *cigar-tube*—the artisan with his *rule* or his *pipe*—the rustic, with a *twig* or a *straw*. The content of any measure is very simply ascertained in the public markets or streets, so as to detect fraud instantly, and deal with the parties

N. 14. Mr. GINGELL—*continued.*

accordingly. The Inspector is placed in a different situation; he can go into the markets almost unobserved, with his rule or his walking-stick; he can test any measure, and, if defective, seize it. By the present plan, any vessel holding the respective weight of water is legal; to prove this by water, the Inspector has to attend the crowded avenues of a public market, with his imperial standard, requiring three men to carry it, another to carry the water there, to examine all measures, which are generally made of wood, some very old; the Inspector, before he can try any, must make them *waterproof*; much time is lost in this operation, and the formidable appearance of the standard in the public market is a signal to the fraudulent, and all the defective measures are instantly transferred to other parts of the town; and the object sought by the Inspector, for the benefit of the public, defeated, which would not be the case with the above system.

(Specimens of measures, of wood, pewter, and earthenware, constructed on this principle, were forwarded to the Commission by Mr. Gingell.)

N. 15. GLASGOW COMMITTEE.

The Committee conceive, that all measures to be used by dealers, &c. ought to be made according to a regulated form.

Much injustice is understood to arise to the poorer classes, by the use of narrow-mouthed measures; and it is evident that the quantity of water which measures contain is no test of their fairness for measuring solid commodities.

If such narrow-mouthed measures are of a very conical shape, the injustice will be increased; the angle at the bottom will be imperfectly filled, because it is exempted from perpendicular pressure. Potatoes are not unfrequently sold in retail, to the poorer classes especially, by such measures.

To remedy this inequality and injustice, it might be sufficient to enact, that all measures should be of a round form, having a plain and even bottom, of width at top not less than the width at bottom, and of depth not greater than the width at bottom, measured internally.

Lastly, although the limitations to particular metals, contained in the former Bill, be rejected in the present Bill, it is certainly expedient that leaden weights should be prohibited, being liable to great objections, and now disused by the majority of respectable dealers.

N. 16. Mr. HAGGARD.

The scales at the Bank are every day examined by the scale-maker. The weights are verified as often as the scale-maker thinks proper.

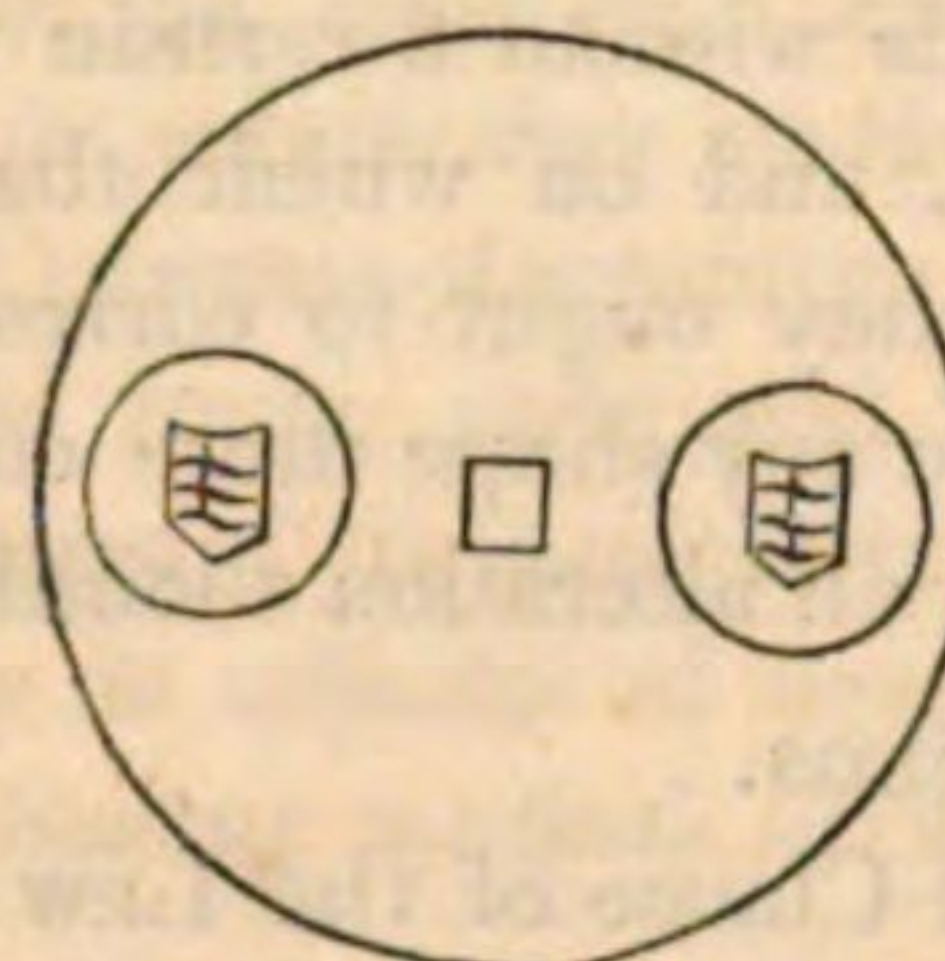
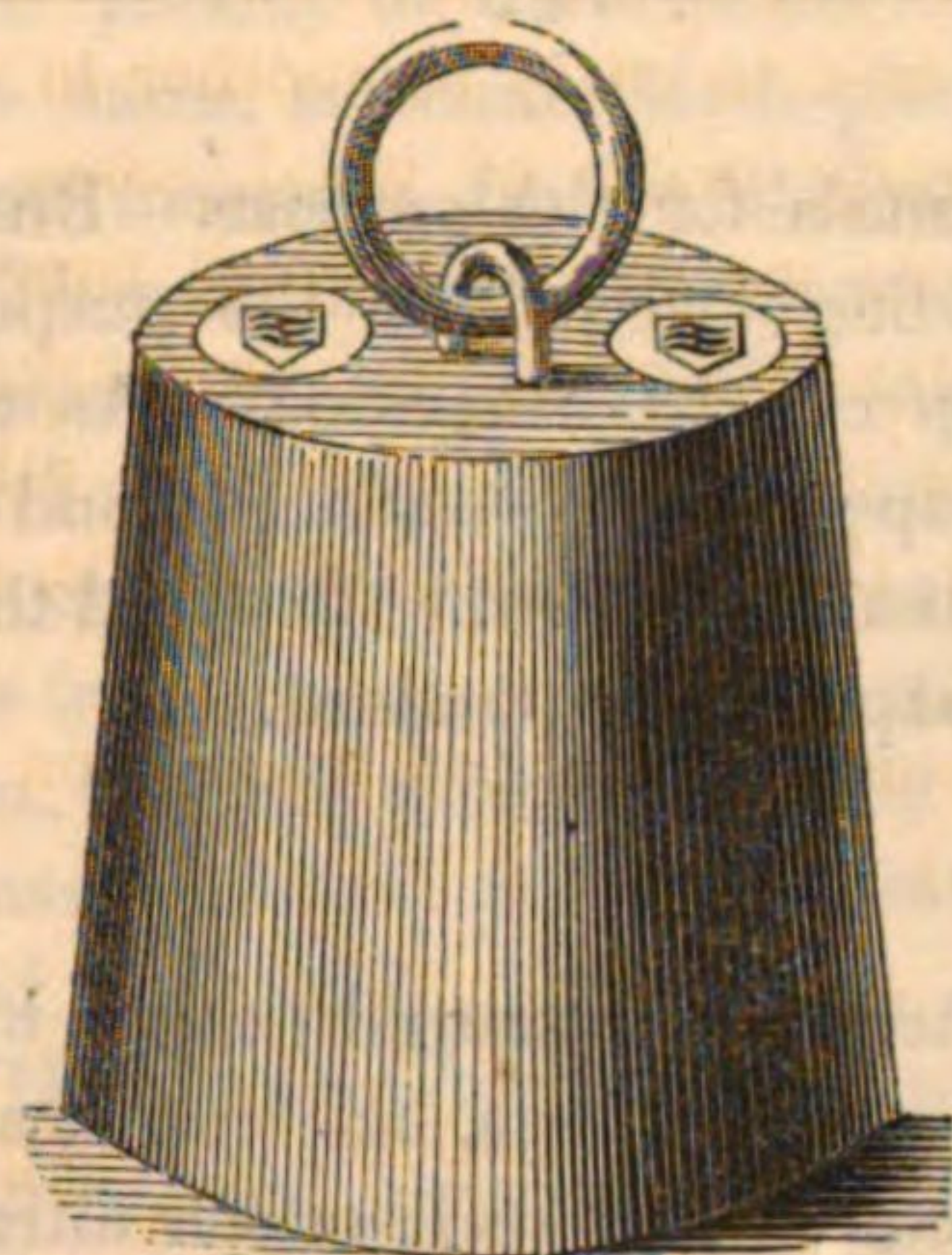
N. 17. Mr. REEVES.

The following suggestions appear to be such as would promote the convenience of the public, and be conducive to a better regulation of weights and measures throughout the United Kingdom. That weight should be substituted in lieu of measure in the sale of all dry goods, and that the wooden measures should be wholly abolished, and none but metal measures, for measuring liquids, should be legal. That the capping of lead should present no greater surface in weights than could be covered by the stamp. That all stamps, except the stamps of cities and counties (and these to be the stamp of the city or county in which the weights, &c. are kept for use), should be discontinued to be considered as legal, and that the powers of the Inspectors should be such that no hindrance to the performance of the duty of inspecting and examining should offer to render that most important duty nugatory.

N. 18. Mr. REEVES.

The annexed sketch may give an idea of the very great impropriety of suffering the capping of lead of weights to extend over a larger space than can be covered by the stamp.

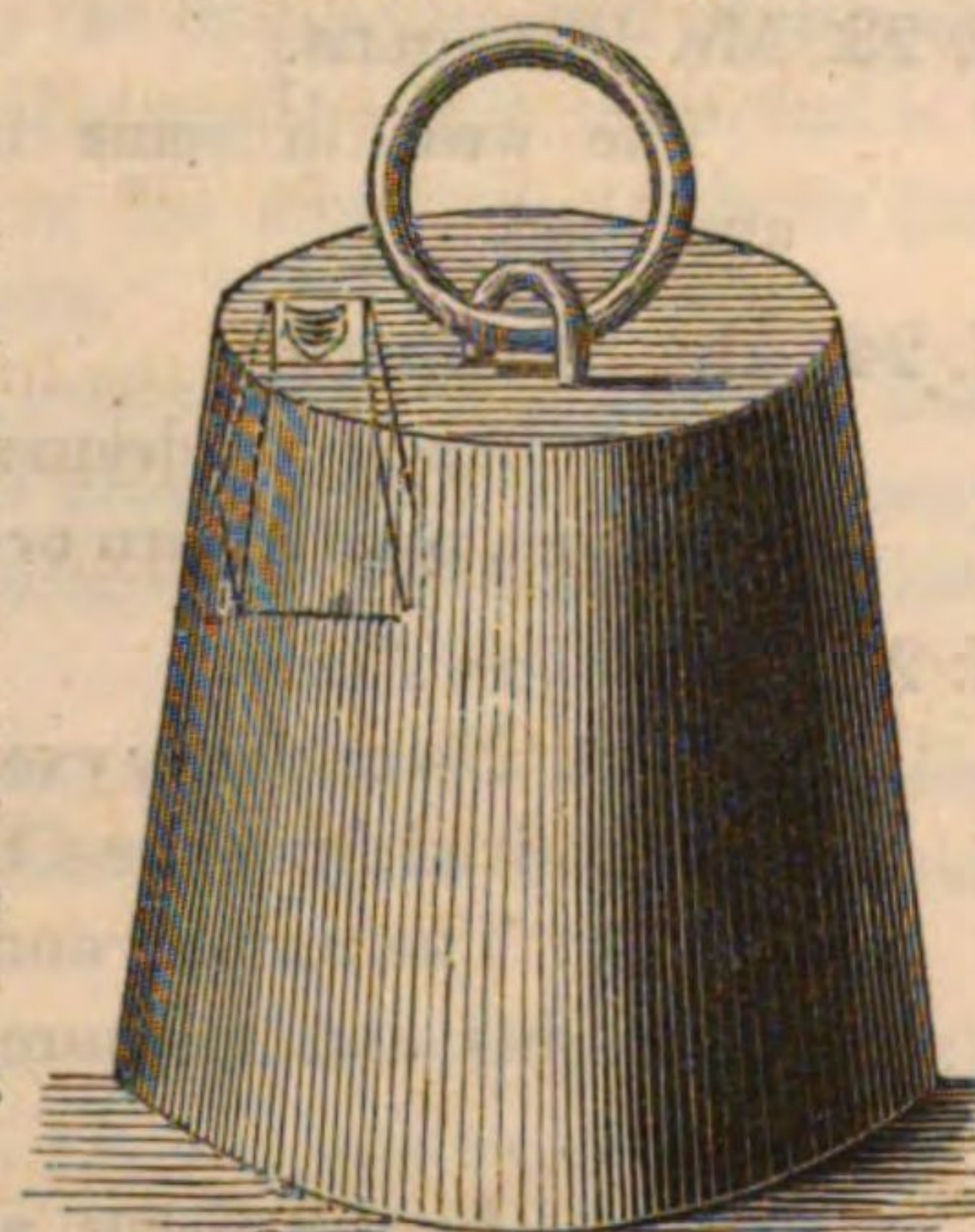
WEIGHTS NOW USED.



The whole of the top of this weight is covered with lead, and not unfrequently there is a hollow at the bottom filled also with lead. This kind of weight is used on steelyards, to weigh heavy weights; the weight is flat, and the lead is generally run in two or three holes, formed in casting, and which being made quite through the weight, there are four or six surfaces of lead presented.

The proposed new weight should be cast with a hollow from the top, into which sufficient lead can be inserted for the purpose of adjusting, leaving a small surface of about an inch and a half or two inches square. The stamp would then cover all the visible lead, and prevent any alteration by cutting away or adding, without being immediately seen. It would, in so doing, efface the stamp, and shew at once that the weight had either never been at the Inspector's for examination, or that it had been altered for unfair purposes. There are many other shapes of weights in use. The shape, perhaps, may not be of such consequence as that the surface of lead should in no case exceed the dimensions named above, and that there should be only one surface of lead. It is obvious that, in all other cases, any alteration may be made to suit the purposes of fraudulent dealers.

PROPOSED NEW WEIGHT.



N. 19. Mr. REEVES.

One fraud to which the present system is liable is the alteration of weights and measures by persons so disposed, after they have been examined and stamped at the Inspectors' offices. The modes of fraud in cases of weights are effected by cutting away, or adding to, the lead of iron weights, and by filing away the brass weights. In measures, the capacity is altered by driving up the bottom of the measure, which is easily done after drawing a few small nails; and a considerable alteration is made in the contents of pewter measures by striking up the bottom.

A remedy has been suggested in the previous communication to prevent alteration of iron

N. 19. Mr. REEVES—*continued*.

weights, adjusted by means of lead, *viz.*, reducing the surface presenting to a size which can be completely covered by the stamp.

As regards brass weights, no means appears to suggest itself, except the dread of detection by a well-regulated inspection. The same observation will apply to the measures.

N. 20. Mr. REEVES.

Iron, brass, and zinc, are the most preferable metals for the purpose. But no iron weight can be made without a certain quantity of lead being inserted for the purpose of adjusting when worn, and on which the Inspector's stamp can be impressed. As to the shape of measures, they ought to correspond with the shape of the standards; and there does not appear to be any shape more convenient for use than the present. It would therefore be preferable that an alteration should be made in the shape of the standard.

N. 21. Mr. REYNOLDS.

Proposed Clause of the Law:—

That no scale-maker should alter any weight after being stamped (either by cutting off or plugging), leaving the stamp thereon, as is at present the case, but that in all cases the *cap* should be remelted, and be reverified by the Inspector. Any scale-maker altering the weights as aforesaid, without being reverified, should be liable to a fine of £5.

N. 22. Mr. REYNOLDS.

There can be nothing better than brass for the tradesmen's smaller weights, and iron for the large; and, for the prevention of imposition, all weights ought to be solid, and of one shape and make; and, with regard to measures of capacity, I consider there should be no wood measure allowed less than a quarter of a peck, and that all wood measures should be of the same diameter and circumference as the standards.

N. 23. Mr. REYNOLDS.

The wear in some trades is very great, particularly where grease and salt are sold and used.

N. 24. Mr. REYNOLDS.

The honest tradesman generally employs a scale-maker to examine his weights and measures, once in two or three months.

N. 25. *Sardinian Laws.*

§ 19. No one may exercise the art of maker and adjuster of weights and measures, unless he has received from the Chamber of Finances the proper patents of approval.

§ 20. The makers and adjusters thus approved may exercise their art only for that quality of weights and measures, and in that district, to which they shall be authorized by these patents.

§ 21. In the towns and districts in which the proclamations of the Chamber (*Manifesti Camerali*), dated 28th August, 1815, and 28th June, 1817, have not been promulgated, the makers and adjusters actually in the exercise of their trade are authorized to continue in it for six months after the publication of the present regulation, within which time they must obtain the proper patents of approval.

§ 22. For the future, no one can be admitted to the exercise of the art of maker and adjuster of weights and measures, except he be of age, and give proof of having worked for one year at least in the work-shop, and under the immediate direction of a patented maker, by a sworn declaration, which is to be delivered by the said maker to the Judge [*del mandamento*].

§ 23. Not only those already exercising the art of maker, &c. (of whom mention is made in

N. 25. *Sardinian Laws—continued.*

Art. 21), but also those who (having the qualifications required in Art. 22) shall in future aspire to the exercise of that art, are to undergo the proper examination, with the exception hereafter mentioned in Art. 27, as applying to the former; and, in order to be admitted to it, they must present to the Chamber of Finances a memorial in which shall be stated their respective name, surname, birth-place (*patria*), and dwelling-place; and also, the quality of weights and measures, for the fabrication and adjustment of which they wish to be approved.

§ 24. They shall add to the memorial an extract from the register of their baptism, and a declaration of the council of the town or community in which they reside, certified by the Judge [*del mandamento*] in proof that they are reputed persons of probity.

Moreover, those who are at present in exercise of the trade, must add to the memorial a certificate from the same council, testifying that, at the time of the promulgation of the present regulation, they did exercise publicly the trade of maker or adjuster of weights and measures, and the new aspirants are to present the certificate of having worked at the trade, which is mentioned in Art. 22.

§ 25. Having obtained the *declaratoria* of admission to the examination, the aspirants of both these classes must present themselves with the same to the examiners, who shall be deputed by the Chamber of Finances, by whom shall be prescribed to them the specimen of work which they are to construct [*da' quali verrà loro prescritto il capo d'opera da formarsi*], which being done, they shall undergo the verbal examination.

The specimen of work is to consist, as well in the local weights and measures to the fabrication and adjustment of which the aspirants intend to apply themselves, as in those of the metrical system; and the verbal examination shall turn upon the knowledge of the aforesaid weights and measures, both local and metrical.

§ 26. In the certificate of fitness which is to be forwarded by the examiners, there shall be particularly expressed, the quality of weights and measures, to the fabrication and adjustment of which the competency of the aspirant is recognized; and afterwards a new memorial is to be presented by him to the Chamber of Finances in reliance on the aforesaid certificate (*con fede del suddetto certificato*) in order to obtain the proper patents.

§ 27. Those among the present fabricators and adjusters (treated of in Art. 21) who shall prove a continued exercise of their art for six years before the promulgation of this law, may, according to the particular circumstances, receive patents of admission, without the condition of the specimen of work and the verbal examination.

§ 28. The fabricators and adjusters of weights and measures, must exercise their profession according to the rules of the art, and in the terms of the instructions given by the Chamber of Finances (*Istruzioni Camerali*.)

§ 29. They must be furnished with the necessary standards, verified and marked by the verifier or standard-man of the province, conformably to Art. 15, and will be obliged to have the verification repeated in the month of January of each year.

§ 30. The fabricators and adjusters of weights and measures are to affix on every measure or weight, which they shall construct, or which shall be presented to them for adjustment (when the measure or weight shall admit of it), an inscription, from which the nature of the measure or weight may be clearly and unequivocally recognized, and particularly whether it be metrical or local, and of what province.

§ 31. They shall also affix on the measures and weights constructed by them, their proper mark, which shall consist in a sign or figure of their own choice, and in the initial letter of their surname; which sign or figure is not to be varied without the authorization of the Chamber of Finances.

N. 25. *Sardinian Laws—continued.*

§ 32. The fabricators and adjusters already approved, ought, in the term of one month after the publication of the present regulation, to deposit in the archives of the chief towns of the provinces, the stamp of their mark; and in the term of two months after the same publication, ought to transmit the indication of this mark to the Chamber of Finances.

Those who shall be hereafter nominated, are to transmit the mark which they intend to use to the archives of the chief towns of the province, before applying to the aforesaid magistrature for the patents of approval; and are to produce for that purpose a certificate of the secretary of the town attesting the discharge of this obligation, with a description of the mark.

§ 33. A similar impression (of the mark) is to be sent to the standard-man of the province, who must then send to the said makers or adjusters the declaration relative to it; if the impression has not been sent, the standard-man cannot verify and mark the weights and measures which shall be presented by those makers or adjusters.

§ 34. Makers and adjusters, and all other persons, are forbidden to sell or expose for sale, weights and measures, unless they have first been recognized and marked by the standard-man. In the provinces in which there is no standard-man yet named, this regulation shall take effect in the term of one month from the day in which the name of the standard-man shall be published in the province.

Contraveners of this law will incur a fine of 25 to 100 lire, according to the circumstances.

§ 35. Unauthorized persons making or adjusting weights and measures of any kind (those excepted who are hereafter treated of in Art. 37) will incur a fine of 100 lire, besides the loss of the said weights and measures, and the tools serving for their construction and adjustment.

§ 36. The same penalty will be incurred by approved makers or adjusters, who shall make or adjust weights and measures to which they have not been authorized by their respective patents, or out of the district assigned to them, besides the interdiction of the further exercise of their art.

§ 37. In regard to the measures of capacity for liquids, of glass, earthenware, porcelain, pewter, or tin; the manufacture and sale are permitted to every one without verification or marking, by the standard-man; he will however refuse to affix the mark where they are not regularly manufactured.

§ 49. Whoever shall forge (*falsifichera*) the mark of the makers and adjusters of weights and measures, shall incur the punishment of imprisonment from 6 to 12 months, besides the punishments for fraud, according to the circumstances of the case.

N. 26. Mr. SHARP.

Mr. Sharp has ascertained that his 60 lbs. troy weight has worn away in the half-year as much as 30 grains; of course it has not been used in that incorrect state, but the weight added to it by plugging at various times during the half-year, has been 30 grains at least.

The weights are sometimes used for many days together, from 10 o'clock in the morning till 8 o'clock in the evening, and then perhaps for a week or ten days, very little.

The weights are made of bell-metal, which is hard. The wearing is produced by the grits and sand from the packages of specie and bullion which are opened on the counter, and are generally very dirty as they come out of the ship's hold; and there is also often much dirt among the specie and on the surfaces of the ingots.

Cork is sometimes used for the smallest weights (the half pennyweight and the grain); this is the case at the Mint and some other places.

N. 26. Mr. SHARP—*continued.*

The stamp on the weights is not to be received as sufficient evidence of the accuracy of the weights, as the error produced by wearing in a short time is far too great to be tolerated.

Mr. Sharp's weights and scales are examined by his scale-maker once a week at least, and no sensible error is tolerated. The examination occupies about half an hour. The correction of the weights of course occupies a much longer time, but having nearly three complete sets the scale-maker takes the defective ones home with him to repair.

This care is greater than usually taken, as the wear is much greater than in any other establishment, excepting the Bullion Office, Bank; it is usual, however, with all who use weights and scales for bullion, to have them periodically examined. But when every care has been taken, there are various causes of inaccuracy; the pan of the scale is subject to wear; want of skill and experience in using the scales, or intentional dishonesty, as when large weights are nearly balanced, it is possible by a sleight in weighing, to cause either side to preponderate. For these reasons, in Mr. Sharp's office and other establishments, the weighing is intrusted to persons well accustomed to the use of scales and having no interest in the result.

N. 27. Mr. WADE.

The frauds to which the present system is liable, are, by stamping yard measures without reference to the sub-divisions, and by stamping iron weights with two plugs of lead in them, as they can retain the stamp on one plug, and alter the weight by the other.

N. 28. Mr. WADE.

I do not know any better metal for tradesmen's weights, than gun-metal for small weights, and cast-iron for the large; but they might be much improved in shape and construction; there are two new sorts of weights introduced, but I do not think either will answer the purpose; the one is delph ware, which appears to be too soft a material; the other is zinc, which if authorized by Act of Parliament, would soon be so much reduced with other metal for the sake of cheapness, that it would be little better than lead, which is prohibited by the present Act.

N. 29. Mr. WADE.

The wear of tradesmen's weights differs according to circumstances; for instance, those of pork-butchers, cheesemongers, and oil-shops, where they do much business, wear light very soon, owing to the salt and grease; the 4 lb. to the $\frac{1}{2}$ lb. will vary from 2 to 3 drachms light in the year, while bakers' and several others would not vary more than half a drachm in the same time.

N. 30. Mr. WADE.

One of the greatest evils is in allowing weights and measures to be sold without being stamped. Under the 14th clause of the 4 and 5 Wm. IV. cap. 49 (now repealed), there was imposed a penalty not exceeding five pounds on any person who shall sell, expose to sale, or use any weights or measures which have not been so stamped, or which shall be found light or otherwise unjust. When this clause was in force, the manufacturer could not make any but correct ones, which I consider to be one of the most essential points of the Act; but at the present time you may buy new brass weights at certain scale-makers' shops four ounces light in the pound, and there are some pewterers making measures with false bottoms from one-fifth to one-third short; you may likewise buy at brokers' and marine store-shops unjust weights that have been worn out and condemned by Leet Juries, &c.

N. 31. Mr. WADE.

Suggestions for the amendment of the Act now in force :—

Clause 12. And be it enacted, that all weights which shall be made after the passing of this Act, shall have their contents denominated, stamped, or cast on the top or side thereof, in legible figures and letters; and that all measures of capacity which shall be made after the passing of this Act, shall have their contents denominated, stamped, or marked on the outside of such measures, in legible figures and letters.

Clause 13. And whereas the use of weights made of soft materials affords facility to fraud; be it therefore enacted, that after the passing of this Act, no weight made of lead or of pewter, or of any mixture thereof, shall be stamped or used; provided always, that nothing herein contained shall prevent the use of lead or pewter, or of any mixture thereof, in the manufacture of weights, if they be wholly and substantially cased with brass, copper, or iron, and legibly stamped or marked "cased," or shall prevent the insertion of one plug of lead or pewter into weights as shall be *bonâ fide* necessary for the purpose of adjusting them, and of affixing thereon the stamp hereinafter mentioned.

N. 32. Messrs. WARNER.

The best metal for tradesmen's weights, is either gun-metal or a composition called pot-metal, or iron. The enactment is good which prohibits lead or soft metal weights, but it also ought to prohibit yellow brass, on account of the oxidization. Some regulation respecting the lead which is introduced into the iron weights appears to us necessary, or otherwise stamping amounts to very little. We would propose that only one place should be allowed in each weight for lead at the top round the ring on which the stamp is placed, and then the lead cannot be removed without destroying the stamp, but at present there are often two or more places, one of which can be removed, and the stamp remain on the weight; such instances only prove that the stamp may be rather a shield under which false weights may be more securely used, than a protection against fraud. The measures now in general use are convenient, and give general satisfaction; *viz.*, cylindrical for dry goods and some liquids, conical for others.

N. 33. Messrs. WARNER.

The wear in tradesmen's weights altogether depends upon the use made of them, whether exposed to the weather, and the peculiar trade in which they are employed. Some articles, such as salt and sugar, have great effect upon iron weights. In some cases a 56 lb., 28 lb., or 14 lb. weight may vary half an ounce to 2 ounces, in others not a drachm. No exact estimate can be given of the variation in the measures, some of which are of wood, others of tin, copper, or pewter, and we believe are seldom re-examined, unless they are rendered useless from a hole, and are obliged to be repaired; bruises, as in pewter pots, are seldom taken much notice of.

N. 34. Messrs. WARNER.

Most respectable tradesmen, in London and other large towns, employ scale and weight-makers to examine and correct their weights, &c., which is attended to at wholesale houses every three months; this practice would be more general in country towns and villages, if the inquests were more vigilant.

N. 35. Messrs. WARNER.

We preserve the accuracy of our own standards by keeping an extra set carefully preserved, which are only used to detect any inaccuracy in the set we have in common use, and by occasional reference to the Exchequer Standards.

N. 6*. Colonel COLBY.

The standard chains with which our working chains are compared in Ireland, have 25 links and two handles, making altogether 27 pieces.

They are made of the best iron wire .235 of an inch in diameter, and weigh about twelve pounds.

The loops at the ends of the links are pinned fast, and one handle has an adjustment to regulate the length. Their price is £5. 5s. each.

My officers examine and regulate their lengths before they send them for the use of a detachment of the surveyors; and the surveyors fix two marks at the proper length for the comparison of the working Gunter's chains every morning, and return the standard chain; so that our standard chains are not subjected to any wear between the period of their regulation and the period when they are applied to settle the distance of the marks.

N. 14*. Mr. GINGELL.

I must beg to submit that testing by any scale must fall to the ground unless all measures are made cylindrical and kept perfect and entire: the test cannot be accurately performed without it; some of those now tested, when made, no doubt were so, but from contraction, expansion, and wear, have become warped and so much out of circle that a difficulty exists as to the diameter line. There are a great many old measures in use where the depth varies from $\frac{1}{4}$ to $\frac{1}{16}$ of an inch, and I am sorry to say that very little attention has been paid to this, by the respective makers: they all ought to be gauged to depth. Another difficulty exists in the best made bushels; they have an iron top, brought up to a thin edge, and the whole of the sides of the bushel a little tapered to meet it; and thus it forms a section of an inverted cone instead of a cylinder. The scale in this case will not check its contents. The bushel is made thus to cut its way through a heap of corn; if made with its bevel outside, all the purposes would be answered.

Measures have been allowed to be made of all diameters; in dry goods the various diameters give various contents, which has opened a door to fraud; for example, the dealer in corn or seeds will buy by the bushel of 19 inches diameter and sell by one of 14 inches, thus he has the advantage of the action of the strike over the larger surface. You will find that two bushels of the diameter quoted, will not give the same in corn or seeds. The contents of the 19-inch bushel cannot be put into the 14-inch bushel. I think this a strong reason why we should have a legislative enactment to put a stop to the endless variety now in use, because it would produce uniformity in shape and content. In this case, my scale (see N. 14) would prove the most simple test, requiring no calculation.

If the present system of shape and make should be continued in use, then your scale will admirably answer all the purposes intended. I have also a favourable opinion of the other scale, particularly if it can be made on one stick with 10 sides.

N. 16*. Mr. JUGGINS.

The enamel weights, of which you have a specimen, could be much improved, if brought into general use. In answer to your questions—1st, the proportion of lead, with a small portion of glazier's putty (which I use to prevent the heat of the lead cracking the weight) is—

For a 4 lbs. weight	.	.	2 $\frac{3}{4}$ lbs. of lead
2 lbs. .	.	.	1 $\frac{1}{4}$ lb.
1 lb. .	.	.	8 $\frac{1}{2}$ oz.
$\frac{1}{2}$ lb. .	.	.	4 oz.
$\frac{1}{4}$ lb. .	.	.	1 $\frac{3}{4}$ oz.
2 oz. .	.	.	1 oz.
1 oz. .	.	.	$\frac{1}{2}$ oz.

N. 16*. Mr. JUGGINS—*continued*.

I beg to remark that I consider a great improvement may be made by using metal which requires a less temperature to melt.

The earthenware shell may be made of any thickness and strength, and the proportions will vary accordingly. I beg to present you with a 1 lb. weight before filling, and you will observe the exposed surface for stamping may be made of any size and shape to fit the stamp; and the strength of the material is such that it will allow the operation of stamping.

(Specimens of the enamel weights, filled and unfilled, were sent by Mr. Juggins.)

N. 24*. Mr. REYNOLDS.

I consider that both the scales [for gauging cylinders] are excellent, but yours I give the preference to, because the scale is on two sides only, and the other would be so large to have a sufficient number of scales upon it. If the other scale is adopted I think it would be advisable to have a separate scale for each measure, which could slide one in the other; it would prevent the possibility of error. I have tested some of the same measures with water, and have found them agree as nearly as possible. I am so satisfied with the accuracy of the scales that I think it will entirely supersede the necessity of requiring a particular proportion of the diameter to the depth.

SECTION O.

MISCELLANEOUS PAPERS, PRINCIPALLY RELATING TO THE EXTENSION OF THE LAWS OF WEIGHTS AND MEASURES.

O. 1. Mr. BATE.

In regard to measures exceeding the gallon in capacity, I think all larger ones may be readily dispensed with, as in the sale of fruit, vegetables, coal, corn, spirits, beer, &c., &c., the quantity would be more easily and satisfactorily determined by weight. The spirit dealers among themselves have for some years adopted this system.

And as the corn-meters at Mark Lane publicly boast of their skill in filling a bushel measure to nearly half a gallon plus or minus of its proper contents, this should prepare us against a system of measure of capacity so open to fraud.

O. 2. Mr. BATE.

I am not aware that there is any check under the recent Acts on tradesmen using defective balances, as I believe that the County and Local Inspectors merely confine themselves to verifying and stamping such weights or measures as may be brought to them and prove correct.

Fraud is as likely to ensue from an incorrect balance as from a deficient weight; this subject requires serious consideration.

O. 3. Mr. BLACKBURN.

The Indian Standard Weight is the only one I know of requiring further comparison, as in 1836—the factory—bazaar and Indian maund underwent considerable alteration.

The best tables of reference for all foreign weights and measures I have ever met with, are to be found in Kelly's "Universal Cambist," 2nd edition.

O. 4. Mr. BROWNE.

The house I am connected with, formerly Browne's and Brind, now Browne and Wingrove, is appointed by the Bank of England to melt, on their behalf, bullion, both gold and silver; and the merchants have invariably given their business, so that nine-tenths of all the bullion imported passes through my scales; dollars are not included; and I may say, that under existing regulations no difficulty is experienced as to weight. I have many weights and scales. I employ one of the best scale-makers, and give him six pounds a year to keep the same in proper order. Now, I suppose he has access to some standard equivalent to that destroyed by fire, by which he may compare old weights and make new ones, and so have it in his power to keep my weights in due order. I have one scale-beam which has not varied by ten years' use, and all gold sent into the Bank is weighed by this beam; not a day passes but some comparison is made with the Bank weight, and very seldom is there any variation. Whatever mathematical nicety may be necessary in the first formation of a weight or measure, that is soon lost in practice. To illustrate this, suppose the Bank scale and weights to be absolute perfection, and

O. 4. Mr. BROWNE—*continued*.

mine to be the same. I have occasion to sell the Bank a bar of gold, say 15 lbs. weight. It is the custom of the Bank to have a certain turn in their favour in buying, and if they send the same into the Mint to be coined, a certain turn of the scale is there required; now in the Bank transactions no weight is allowed less than 12 grains, so if my weight and scale indicated 15 lbs. it would not pass at the Bank unless 12 grains were deducted. Now it would be possible that my 15 lb. weight might be three, six, or nine grains light, and yet the selling the 15 lbs. of gold to the Bank would be one and the same thing, for in a very good balance that want of weight might be detected, but no less denomination than 12 grains would be satisfactory. In the same way silver is estimated; and in a thousand ounce bar, half an ounce is the turn usually given and taken, so extreme accuracy is not required.

O. 5. Mr. DE GRAVE.

I consider the Act of 1824 did much good, and that the Act of 1834, much more harm than good; but the Act of 1824 did not go far enough; at that time the 112 lb. weight might have been altered to the 100 lb. with very little more inconvenience than was at that time felt. The 100 lb. divided as before stated would be much more convenient than the 112 lb. for many reasons.

O. 6. Mr. GINGELL.

Remarks on the Act now in force:—

The present Act is full of legal errors, it is a jumble of disjunctions, there are not two lawyers to be found to agree upon any one of its sections.

In my opinion it is a nullity; there is a doubt upon the general authority to Inspectors, and in section 28, upon which section the whole law bears, there is a fatal error; there is no power to give an authority to enter where goods are *measured* for sale, only "WEIGHED."

I would propose that such sections of the various Acts, as have reference to weight or measure, such as the "Licensed Victuallers," the "Beer and Cider," &c., with the whole subject of weights and measures, should be brought forward and condensed into one "Imperial Act." That every local custom whatsoever, should be abolished, and all commodities or things shall be sold either by weight or by measure, and in no other way: that no person shall possess or use any weight or vessel, for the weighing or measuring any commodities or things, but such as shall be the legal and verified standard of the United Kingdom.

The 5th and 6th Wm. IV., cap. 63, section 6, abolishes all local and customary measures, and enacts "that every person who shall sell by any denomination of measure other than the 'Imperial,' shall forfeit a sum of 40s.;" yet in the latter part of the same section it provides that you may sell by any measure you please if you will not call it "Imperial." This upsets the whole system of measures, so that neither Magistrate nor Inspector can safely act under the section. The public are aware of this, and it is quite unsafe to press a conviction.

Sec. 21. This is the most important of the whole; it is a jumble of disjunctions, so bad, that the leading lawyers of this city cannot safely advise the magistrates to act upon it. "Using or possessing" here stands prominent. The possession of any defective weight, measure, or false balance, I contend to be *bonâ fide* "using;" it is impossible the Inspector can prove the using. Shopkeepers possess two sets of weights, publicans two sets of measures; both for ulterior purposes, and invariably say "We never use the unstamped or defective ones." The penalty should be attached to "possessing" or "using," one or the other; "light or unjust"—does this mean the same thing? "Unstamped or unjust"—a weight or measure may not be "unjust" though "unstamped." A diversity of opinions are held upon the meaning of these expressions, thereby rendering them useless. "Represented as containing the amount of any

O. 6. Mr. GINGELL—*continued.*

imperial measure," this opens a door for endless disputes. In reference to Licensed Victuallers, to whom this section chiefly applies, the English, by the 9th Geo. IV., cap. 61, *may* sell, "if required;" the Scotch, by the 9th Geo. IV., cap. 58, *shall* sell "if required." The Beer Act, 1st Will. IV. cap. 64, leaves out the ugly words "if required;" so that the landlord of an alehouse cannot sell by any other than "imperial measure," yet the licensed victualler may sell by any measure he pleases. The Beer Act would be efficient but for the 6th section of the 5th and 6th Wm. IV., cap. 63, which destroys its effect, and is also rendered doubtful by the present section. I now refer you to the annual licence, which is founded on all these sections; it runs thus:—"You shall not use in the selling any liquors, any measures that are not of the legal standard." It cannot be a sale until delivered or consumed, and the vessel so used in such delivery, proving short, creates the offence. If they sell by any other than measures of the legal standard, they certainly forfeit their licence, and subject themselves to the penalty in the Act upon which their licence is founded. By the 9th Geo. IV., cap. 61, it would appear, that a landlord may sell by any measure or in any vessel he pleases, unless his customer "require imperial measure."

The 6th and 21st sections of the 5th and 6th Wm. IV., cap. 63, have given birth to a variety of measures, by the names of can, tankard, jug, nip, mug, &c., &c., which are all different from imperial, yet charged as such. A landlord possesses only three stamped vessels, *viz.*, quart, pint, and $\frac{1}{2}$ pint, and in these he pretends to draw all his liquor for one or two hundred customers; he has in his house a hundred cups, all short measure, which he tells you he does not use as "measures;" yet he pours the contents of a stamped one, or as much as is necessary, into the short cans, cups, jugs, &c. The publicans are impressed with an idea, that three stamped measures are sufficient, from having had some communication with Lord Ebrington, wherein his lordship stated, it was not intended by the Act they should have all their measures stamped, but if they drew in a stamped one they might pour it into any other. They say they keep their cans, &c., for the use of their more respectable customers, who do not "require" imperial measure.

Again, there is another wholesale fraud, committed upon artisans in manufactories, &c. Beer is sent out in tin cans, representing $\frac{1}{2}$ gallons, gallons, and 2 gallons, which are from $\frac{1}{2}$ pint to a pint short of the imperial; here is no check at hand by a measure of comparison.

To remedy this evil, it should be enacted, that every vessel of wood, metal, earthen or stone ware (glasses of the ordinary shape only excepted), used for the sale of any article, commodity, or thing, shall be stamped.

To shew the efficiency of a former Act: by the 55th Geo. III., cap. 43, Inspectors appointed by magistrates, can enter any house, and examine and seize any vessel of less capacity than the Exchequer standard, without any authority except being sworn to execute their office faithfully.

Sect. 28. Upon this section the authority to search is founded; it is the opinion of legal men, that from the looseness of this section, Inspectors can only seize weights that are in or near the scales, so as to warrant the "using;" that he has no right to search in drawers and boxes where he suspects defective weights are hid, and that he cannot seize any unstamped weight or measure, provided it is not defective. The section runs thus:—"At all seasonable times to enter any shop, &c., wherein goods shall be exposed or kept for sale, or shall be weighed for conveyance or carriage;" here is a serious blunder, the words "or measured" are entirely omitted, so that all persons selling by any kind of measure can escape. The Inspector is "directed there to examine all weights, measures, steelyards, or other weighing machines," which means only "where goods are exposed or kept for sale;" now you may find goods exposed for sale in one place, and the weights, scales, &c. in another. The Inspector is here liable to an action for

O. 6. Mr. GINGELL—*continued.*

trespass if he insists on searching beyond where "goods are exposed for sale." A farmer measures his corn in his barn, it is carried to his granary for sale, or it may be "measured for carriage," and not intended for sale at the moment, though it is, should his miller call. This may apply to all measured goods; the measures and the article exposed for sale may not be on the same premises, thus an Inspector is defeated. Again, the same thing occurs with a dairyman's butter, cheese, bacon, pork, &c.; the goods are exposed but not intended for sale where you see them; yet intended to be removed for sale, the next market-day; you often find the weights, scales, or steelyards, in the kitchen, though the goods are in the dairy. The Inspector should have a general authority, and be allowed to search in every shop, store-room, stall, and place (excepting a bed-room, although I have found several defective weights in that situation), and in the cart or basket of every hawker of provisions or vegetables where he or she may have goods for sale. "And if upon such examination, it shall appear that the said weights or measures are light or otherwise unjust, the same shall be liable to be seized and forfeited:" light and unjust cannot be defined; unstamped cannot be unjust; "every person who shall have in his or her possession a steelyard, or other weighing machine, which shall on examination be found incorrect or unjust, or who shall refuse or neglect to produce for such examination, when thereto required, all weights, measures, steelyards, or other weighing machines, which shall be in his or her possession, or shall otherwise obstruct or hinder such examination, shall be liable to the like penalty." The latter part of this section is so disjunctive, sweeping, and undefinable, that I can venture to say an Inspector is not authorized to seize any steelyard or other weighing machine, if he finds it ever so unjust. The want of power to seize weighing machines is a serious omission. The whole spirit of the Act is concentrated in sections 6, 21, and 28, yet so badly do they agree, that I am satisfied an Inspector cannot act safely under either of them. Under the 35th Geo. III., cap. 102, Inspectors appointed by magistrates can enter any house, shop, store, &c., and examine any weights or balances; seize the same if found to be unjust; break up and destroy the same without any other authority than being sworn to execute his office faithfully.

Substituting weight for measure would remedy many present inconveniences. The class of goods I propose to be sold by weight only, are corn, seeds, lime, oysters, fruit, vegetables, honey, fish, and seed-oils, vitriol, turpentine, &c. Oils and turpentines are now sold by weight, wholesale; and upon inquiry amongst the retail dealers, I find it would be more satisfactory to them and the public to have them retailed also by weight. Beans are now sold by weight, why should not pease? Lord Ebrington once told me, apples and pears were sold by weight in some parts of the country. Potatoes are sold in London by weight, and in no other manner; a difficulty presents itself in placing potatoes, turnips, or fruit, to the level of the brim of the measures, as the 7th section of 5 and 6 Wm. IV., cap. 63, prohibits heap measure. Thus we get rid of measure in all dry goods, and a proportion of liquid; the only articles that should be sold by measure, are the excisable liquids, such as spirits, compounds, cordials, wines, vinegar, beer, ale, and cider.

Preserving uniformity of measures, as regards shape and form, for this class of liquids, would be unimportant, because shape has nothing to do with contents in this instance; therefore the copies of the imperial standards verified and stamped by the Chamberlains and Auditors of the Exchequer, subsequent to the Act 5 Geo. IV., cap. 74, for the various corporations of the United Kingdom, would be still valid.

O. 7. Mr. GINGELL.

Notwithstanding the ingenuity of the improved instruments under the various scientific names, frauds cannot be detected or discovered in gauging casks; for example, the unequal or

O. 7. Mr. GINGELL—*continued*.

flat staves or false chine-heads of 4 or more thicknesses; staves of various thicknesses; and boring part is no test for the whole; the only accurate test, and the only one which ought to be recognized, is the measuring by the gallon imperial with water at proper temperature by the proper officer; and the contents should be stamped thereon, as on other measures of capacity, under the 5 and 6 Wm. IV., cap. 63; and if on any subsequent examination it should be found that any tricks had been practised with such casks, then the same should be seized, and forfeited and destroyed.

O. 8. Mr. GINGELL.

Measure may conveniently be abolished in the wholesale trade, as many articles of liquids are sold by weight; and in the various denominations of spirits, weight is the *test for quality*. The only trade which may call forth an exception may be the licensed victualler, where he may be allowed to sell by retail from a gallon to the half gill of measure; when he exceeds this, it should be weight only.

O. 9. Mr. GINGELL.

In reverting to the substitution of weight for measure, the system, if adopted, would prove satisfactory and work well, which I will endeavour to prove. It would prevent a variety of frauds now practised in measure, particularly in dry goods: I will instance *corn* as one of the most important. 1st, The diameter of the bushel, whether $18\frac{1}{2}$ inches or $15\frac{1}{2}$ inches; this would cause a variation, according to the ingenuity of the practical meter, from $\frac{1}{2}$ lb. to 1 lb., or even more in each bushel. 2nd, The diameter of the strike. 3rd, Expansion or contraction of grain. 4th, Expansion or contraction of bushel; the measure being kept in a dry place will contract, if kept in the damp will expand; or, *vice versâ*, the corn will expand by a damp atmosphere or by sweating in the bulk, or contract when exposed to a clear dry atmosphere. It may often occur that the *measure is contracted*, and the *corn expanded*; these circumstances, in their connection, produce considerable difference in 100 quarters of corn, which would not occur in weight. 5th, The mode of filling the bushel from the heap; there is a good deal of tact in this, which may be proved by employing men who will take a bribe: these meters will ask the employer, Are you a buyer or seller? Two men filling from the same heap will measure very differently. 6th, If sober, they may measure with a *light hand*. 7th, If they have drank strong liquor they measure *heavy-handed*. 8th, The meter striking his *toe* unperceived against the bushel, or a shake of the hand. 9th, The vibration of the floor where grain is measured. 10th, In a ship's hold, filling the bushel under the *run* or hatchway where the corn forms a solidity, and is clean; or at the ship's side where the corn is loose and dusty; this will cause a variation, more or less, from 5 to 10 lbs. per quarter. I beg to mention these as reasons why I am anxious to abolish measure for weight; other goods sold by measure would form the same proportion of fraud.

O. 10. Mr. GINGELL.

I am of an opinion that under the old system of measure, the endless variety of names, and the discrepance in the multiples (even of the same kind) in the various counties, are most tiresome and embarrassing to any individual or to any committee inquiring into the subject; and until some simple plan is brought forward to prohibit *local* and *customary* measure, there will always be disputes; for wherever this exists it will always facilitate the purposes of fraud, and operate against the price-current of the various markets of commodities, giving a statement both in quantity and price.

O. 11. Mr. GINGELL.

Weigh-bridges and Weighing Engines.—The statutes do not sufficiently recognize these very useful machines; property to a very great extent is bought and sold over these engines, the keeper of which ought to be most conscientious, as he is the *middle man*; he stands between buyer and seller, there is no check upon him, he may be bought and sold; the engine may be just or unjust, the Inspector has no power; the 5 and 6 Wm. IV. cap. 63, will not authorize him.

O. 12. Mr. GINGELL.

Check weights and measures used by private individuals ought to be examined, adjusted, and stamped.

O. 13. Mr. GINGELL.

The troy weight from the *Diamond Merchant* to the *Banker*, requires a very rigid and scrupulous examination, both as regards *beams* and *weights*, because the most valuable commodities are tested by them.

O. 14. Mr. GINGELL.

In all cases introduce the word “shall sell” instead of “may sell.”

O. 15. Mr. GINGELL.

Suggestions for new enactments:—

In the event of a new Act being to be framed, I propose the insertion of sections to the effect of those undermentioned; which, though omitted in the present Act, are indispensably necessary.

Sect. 1.—Wine Bottles. These are now moulded into any size, and are seldom made into imperial quarts and pints. From and after the passing of this Act, no wines shall be put into any bottles, except those of the imperial standard (a period of two years shall be allowed the holder of wines in stock to clear out); porter, beer, cider, and all other liquids, usually sold by the dozen or bottle, shall be sold in those only of the imperial quantity. This would be a protection to the respectable wine-merchants who sell what are termed No. 15's, 12 of which are known in the trade to contain 3 gallons of old wine measure. There is a scale for bottles from No. 12 down to 18; the 12's contain 32 ounces of liquid, which is 8 ounces short of the imperial quart; the 15's, 26 ounces, and the 18's is 20 ounces, which is an imperial pint only, instead of a quart. It is thus we have wine-merchants advertising their cheap and superior old wines in these No. 18, 20-ounce bottles, against their more wealthy competitors, who sell by the No. 15, 26-ounce bottles. A dozen of the No. 15's contain 2 gallons imperial. In the 22nd section of 1 Wm. IV. cap. 61, it is enacted that every person who shall sell any beer or ale in quantities not less than $4\frac{1}{2}$ gallons or 2 dozen, “reputed quart bottles, &c. &c.” Now, what is this reputed quart? Is it a bottle of either *number* in the above-named scale, or an “imperial quart?” If the latter, it should contain 40 ounces, a size seldom, if ever, made.

Sect. 2.—Stone Bottles. These also should contain the exact quantity they are intended to represent. For this purpose, the Inspector should attend the manufactory; examine and stamp all in their green state; and when dried and kilned, he should attend to re-examine them. All that are found correct, should be taken into stock; but the defective ones should be broken up in his presence. A register should be kept, shewing the number stamped in their green state, the number admitted as perfect, and the number destroyed; the price obtained for the legal ones would pay the maker for the breakage of the illegal. The public are greatly injured by these bottles; in many cases those representing gallons and two gallons will not contain their quantity by $\frac{1}{2}$ pint or a pint, these are sent out from the stores of dishonest dealers in wine, spirits, &c., as containing their full amount; though sold at a lower price than that of the honest

O. 15. Mr. GINGELL—*continued.*

tradesman. The bottles used for blacking, ginger beer, soda water, &c., should be subject to the same system of examination.

Sect. 3.—Earthenware cups, almost exclusively used in this city for short measure, may be examined, stamped, &c., in the same manner as stone bottles. The word "Imperial" and the imperial arms are often stamped on these cups, yet the publicans and beer-house keepers tell you they do not use them as "measures," though they "represent" such. This is sheer trickery, for if a man asks for a pint of beer, it is drawn and delivered to him, in one of them, being in more general use than pewter in Bristol, the landlords preferring them, as they can get them any size they please, making short measure proverbial here.

Sect. 4.—Casks, containing wine, spirits, beer, cider, or other liquids sold by measure, shall be examined by the imperial gallon, and stamped by the Inspector in the same manner as any other measure of capacity.

I am satisfied there is no accuracy in gauging; for example, an imperfect head, flat staves, or false chines, would materially alter the contents, and prove a source of profit to dishonest brewers, wine-merchants, and others. I have also detected a block so placed in the chine that the gauging-stick would rest on it; by this plan, a dishonest buyer may, by sending his own casks to be filled, make a large profit.

Sect. 5.—Butter, in lumps, shall be sold by weight, and in no other way, and any person offering for sale, or possessing in any market, shop, stall, store, or place, or in any other basket or cart, in the public streets, any butter defective in weight, the same being found by any Inspector, will be seized and forfeited, and the parties on whom it is found, shall forfeit and pay the sum of one shilling, for every such pound. I cannot find any Act, Charter, or Bye-Law which gives the power to a Magistrate to authorize the Inspector to seize it, though it is done in many market towns.

Sect. 6.—Candles, tied up in bundles, representing pounds, found by any Inspector in any shop, store, or place defective in weight; the same shall be seized and forfeited, and the persons on whom they are found shall forfeit the sum of one shilling for every such pound. I have discovered there exists an agreement between the shop-keeper and the Chandler that every dozen of candles he may send him, shall weigh only 10 lbs. This puts into the pocket of the shop-keeper 2 lbs. in every 12 lbs., and the poor suffer by having only 14 oz. instead of 16 oz.

Sect. 7.—Selling by short Weight and Measure, although a penal offence, there is no summary mode of punishing the offender. The public have the power to prefer a bill of indictment against the accused, but this is too tedious and expensive; and they would rather allow themselves to be imposed on, than bring the offender to justice by this course. There should be a scale of penalties varying with the magnitude of the offence.

Sect. 8.—Refusing to Sell. Licensed victuallers, when a "pint or quart" of liquor is requested, if they suspect the person, say "We don't draw full measure in this or that room, if you want full measure you must go to the 'tap-room.'" Thus a decent man is shut out of a parlour unless he submits to short measure. What is termed a "can" in this city, is the third part of a quart, yet charged as a pint; if a pint is called for, in nine cases out of ten a "can" is served, such being the local custom. These victuallers will say, "I don't sell measure at all; I only sell cans, jugs, mugs, &c.," thus informations are defeated. I think persons keeping shops or public-houses are bound to sell when required, (unless the applicant should be intoxicated) to every person, notwithstanding there may be an ulterior object.

Sect. 9.—Steelyards. Sect. 28 recognizes these false balances, which by former Acts were prohibited. I have examined some hundreds of them and never found one correct; they are made for sale, not use, and commit a wholesale system of fraud on the public, who have no

O. 15. Mr. GINGELL—*continued*.

check against them, not having a pair of scales at hand. They offer a premium to sheep-stealing, by their portable nature, in disposing of the produce. If they cannot be prohibited, I propose that all "bobs" shall be fixed, and that the steelyard and bob shall have a corresponding mark when examined and found correct by the Inspector. This would prevent the exchange of "bobs" (I have found 3 of these to 1 steelyard), and by this exchange a steelyard will weigh what you please. The bob of a steelyard is a fictitious weight, and cannot be stamped.

I have also known persons with spring balances calculated to weigh only 20 lbs. place 40 lbs. on them, and pretend to satisfy it was all right, as the index would only point to 20 lbs. if you put 50 lbs. on it; the public are not aware of the trickery in these false balances. Spring dials are equally bad, the spring being often out of repair, by contraction or expansion. All kinds of false balances are prohibited in the Customs or Excise departments.

Sect. 10.—Weigh-bridges, whether public or private (if they weigh goods for sale) shall be subject to the same regulations and authority as other scales; although it could not be seized, yet a penalty would enforce attention and cleanliness. These engines, though so long neglected, are of great importance, and ought to be kept accurate. I propose that all weigh-bridges, with weights of a fictitious character, should have the lever altered to correspond with the imperial standard, viz., 1 lb. to represent 1 cwt., or 1 oz. 1 cwt., &c. The contents should be stamped on the weights, so that the public would know the weight of the goods, as well as the engine-keeper; and a scale of them be hung up for public inspection in the engine-house.

Sect. 11.—Intermediate Weights or Measures, such as $3\frac{1}{2}$ lbs., 25 lbs., &c., or 3 pints, 3 quarts, &c., not being duplicates of the Exchequer Standard, shall not be stamped or made legal.

Sect. 12.—Strike for Corn, &c. This should be round, of $3\frac{1}{2}$ inches diameter; and none other should be used.

Sect. 13.—Offences. Every weight, measure, or weighing-machine, if found to be defective, or unstamped, or unjust, shall be taken to be a separate offence; and every drinking cup shall be taken to be a measure, for each of these in reality commits an offence every time it is used. Magistrates frequently (from a good feeling towards the accused, thinking a trifling fine would cure the evil) have awarded for 20 weights or measures a few shillings, which has been cheerfully paid; the accused would go and repeat the offence, because he would get more profit out of the short weight than would equal the penalty.

Sect. 14.—Fixed Penalties. For the guidance of magistrates it would be preferred, that the penalty should be attached to each offence in its proper section; that each offence shall not be less than 5s. or exceed £5, or in such other proportion as may be deemed fit.

Sect. 15.—Forfeitures. Scales, dials, steelyards, or other weighing-machines, if found unjust, ought to be seized and condemned the same as a weight or measure. Sect. 28, 5 and 6 Wm. IV. cap. 63, does not warrant this; it is totally omitted; the power is only given to seize weights and measures. The 31 George II. cap. 17, authorizes the Jury of Westminster to seize and destroy forthwith all defective beams, scales, weights, and measures found on the premises. The 35 George III. cap. 102, gives the same power to Inspectors, yet these two efficient Acts are ridden over by the 5 and 6 Wm. IV. cap. 63.

Sect. 16.—Makers of Weights and Measures, should be prohibited from stamping or marking any weight or measure, with the word "Imperial," G.R., W.R., or V.R. and Crown. By these the attention of the public is directed to the presumed, rather than the official stamp, by which they are often misled. Every weight and measure ought to be quite plain and free from any marks.

Sect. 17.—Adjustment and Verification of all weights and measures ought to be under

O. 15. Mr. GINGELL—*continued*.

the superintendence of an Inspector, as the Act states, in sect. 27, that weights and measures need not be re-stamped unless found to be defective or unjust.

I presume this to mean, when it is found defective it must be re-stamped, and the stamp by the Inspector is to shew the deficiency has been made up. If this adjustment is made by an indifferent person, so as not to obliterate the original stamp, the fee for such re-stamping will be lost to the funds of the city or county to which the Inspector belongs.

Sect. 18.—Models or Copies of Stamps. A weight or measure once stamped, is taken to be a legal weight or measure of the United Kingdom. To prevent fraud and to detect counterfeit or forged stamps, I advise a mutual exchange of models or copies of stamps for general information to Inspectors. For example, W. may mean Wiltshire or Westmorland, M. Middlesex or Monmouthshire, B. Bristol or Bath.

Sect. 19.—Delf weight. This is an entirely new invention, it will be for the Legislature to decide if they are admissible or not. They are, in fact, a cased weight; a Staffordshire ware case filled with cement and lead; there will be a difficulty in stamping, without breaking: the Legislature never contemplated a weight made of this material, and I think there should be none but of metal.

O. 16. GLASGOW COMMITTEE.

No commercial transaction ought to find protection in a Court of Law unless by legal standard weights; therefore the clause in the 2nd section of Lord Ebrington's new Bill, that no old weights are to be used under a penalty of £5 for every offence, ought to be more explicit, and particularly ought to specify that all the weights known by the denomination or name of stone, hundred-weight, and ton, also that the troy pound and its parts, and all other old weights, excepting the avoirdupois pound, are for ever abolished; and that all contracts by said old weights shall be wholly null and void. Uniformity may be insured by Government re-casting all our existing weights, and distributing a proper series of avoirdupois weights, which would be attended with little expense.

O. 17. GLASGOW COMMITTEE.

The clauses in pages 6 and 7 of the Bill, regarding contracts for sales, seem to need revision. It permits "agreements, bargains, sales, and dealings," to be made according to *local* and *customary* weights and measures, provided that the ratio which these bear to the standards shall be expressed, declared, and specified in such agreement; otherwise to be null and void.

But as it is well known that the most numerous class of such agreements, sales, and bargains, consist of those which are *not* made the subject of any *written document*, it occurs, to inquire in what manner this clause is intended to operate with regard to verbal contracts, sales, &c.

In connection with this clause, it appears to the Committee material to the efficiency and completeness of this important Bill, that there should be an express enactment, that no action or suit shall be, or be sustained, in any Court of Justice, for the recovery of the price of goods or commodities, sold, or exchanged, or of damages on account of any contracts, sales, or dealings concerning such goods, &c., unless such suit, action, or claim, be made with reference to the standard weights and measures.

O. 18. GLASGOW COMMITTEE.

The clause allowing existing weights and measures to be used until January 1830, the Committee humbly conceive, puts to hazard the efficiency of this great national measure. All former legislative attempts to introduce uniformity have miscarried, because dealers were permitted to retain possession of their local and customary weights; and no new attempt to

O. 18. GLASGOW COMMITTEE—*continued.*

procure for the country so great a benefit, appears so likely to attain complete success as one which shall be simple in its enactments, and calculated to operate universally at one time.

To reputable dealers, the expense of purchasing new weights and measures by January 1824, will appear of no consideration; and even among the smaller and poorer class of dealers in villages, &c., it will merely be felt as a hardship, and will never excite a murmur.

But once allow an option, to retain for a series of years, the local and customary standards, and laxity will be introduced; the old variety of local weights and measures will be retained in many parts of the country, while the condition annexed to such option will be neglected, and few will be found to take the trouble of causing it to be respected.

If there be any particular reason for allowing this option in regard to local and customary measures, it is believed that such reason can have little force as applicable to weights; for with regard to these, at least, the observation of the condition (namely the painting or marking thereon the ratio which they bear to the new legal standard), will prove equally, if not more expensive, than the purchase of new ones.

O. 19. GLASGOW COMMITTEE.

In the concluding part of the same clause the Bill declares, "that nothing therein contained shall extend, or be construed to extend, to permit any maker of weights, &c., to make any weights, &c., after 1st January 1824, except in conformity with the standard."

This provision appears defective, in as far as it seems scarcely equivalent to a direct prohibition; still it would be inoperative, unless some punishment be annexed to the breach of it. No penalty seems to apply to this case, under any of the statutes of His late Majesty, which are incorporated with the Bill by a subsequent clause.

O. 20. GLASGOW COMMITTEE.

Recommend that no sales should be allowed by heaped measure.

O. 21. Mr. GODFREY.

The informations laid before the magistrates of Suffolk, for false weights and measures, are of a very simple character; an informer being paid by the magistrates to go round the district at different and uncertain periods to lay such informations; without which the labouring classes would be plundered daily and irremediably. The informer is a very respectable man.

As magistrates, we know of no weights and measures but the imperial; and we believe no others are used but those of that denomination in our agricultural districts.

We possess authenticated copies of the imperial standard of length, weight, and capacity. They were obtained from Mr. Bate, of No. 21, Poultry, London, he having been appointed by the Lords of the Treasury, in compliance with the 5 Geo. IV., cap. 74, to construct the imperial standard of weight and capacity. These standards were stamped at the Exchequer; the Exchequer indenture, specifying the several weights and measures, is deposited within their place of custody, and with them is also the "imperial standard yard bed." We here never had any informations in respect of the standard of length, but only of weight and capacity; but we apprehend a departure from the Exchequer standard in the first is equally (with the others) a subject of prosecution under the 5 and 6 Gul. IV. c. 63, s. 28. Our standards are subdivided in the usual manner.

The balance was furnished from Mr. Bate at the same time as the standards; that is, in 1824.

The standards are sent round the district once a quarter, in custody of the magistrates' officer, and due notice of the places of meeting for the various shopkeepers given in the local papers previously, so that none have far to go to verify, and all may know where to go to at these times.

O. 21. Mr. GODFREY—*continued*.

The standards are preserved in the custody of the officer of the magistrates, in the weights' and measures' room at the County Court-House, where they are kept locked up when not used. Their general place of custody where they may be always, when set on circuit, referred to, is always known by public advertisements in the papers.

The weights and measures found deficient by the informer, and seized as such, are, on the informations being heard, compared with the standard by their own officer in the presence of the magistrates.

No inaccuracy is tolerated but such as may be fairly attributable to wear and tear since the last quarterly circuit, and *opportunity* for rectifying.

No practical inconvenience whatever is felt in these agricultural districts under the Acts 5 Geo. IV. cap. 74, 6 Geo. IV. cap. 12, 5 and 6 Gul. IV. cap. 63. The real evils are, that the offence under the 37 Geo. III. cap. 143, sect. 2, is not *cumulative*, as it is, properly, made in respect of *measures* under the 55 Geo. III. cap. 43, sec. 2; and that by neither Act is the penalty *sufficient*, which might vary from £20 to 5s.; the advantage gained by cheating between the visits, however uncertain, of the "Examiner," far more than counterbalancing the extreme penalty levied on a subsequent offence.

O. 22. Mr. HAYMAN.

I have for some years watched the conduct of persons connected with weights and measures, and I have no hesitation in saying that the laws and customs now in existence are exceedingly bad, and that the several Acts of Parliament, both local and general, so far from accomplishing the object they were intended for, are converted by interested persons into the means of extorting money from persons whilst peaceably and honourably following their respective avocations.

O. 23. Mr. HAYMAN.

I would take the liberty just to observe, that most of the irregularities exist through, and arise out of the defective state of the law, and can only be corrected by legislative enactment.

O. 24. Mr. HAYMAN.

Remarks on the Act now in force:—

Before pointing out some of the defects in the present Act, I cannot help referring to the 5 Geo. IV. cap. 74. That was an Act intended to abolish the number of different weights and measures which then existed in various parts of the kingdom, and to assimilate all into one imperial standard; but clause 16 perpetuates the use of all the old ones, and adds one to their number. When the honourable member who brought in that Bill was told of this imperfection in his Bill, the answer was, it must be altered another time. I will only name one result: a person [named by Mr. Hayman,] taking advantage, as did many others, of that clause of the Act, issued hand-bills stating he was authorized to stamp or mark weights and measures under this clause of the Act, by the magistrates of Middlesex, and he commenced this work of stamping to a very great extent in Soho, because the public thought, that by thus complying with the Act, they would save purchasing new measures and weights; however, although the Act did not say who was to stamp them in this manner, *viz.*, the ratio or proportion such weights and measures bore to the new ones, yet it was clear that he possessed no such authority—moreover he charged enormously, and made no comparison whatever with the standards, only marking on them $\frac{3}{4}$. The public at length, by getting fined, found out it was a delusion, and broke the windows of his house, and would have destroyed the house, had he not made his escape. In Lower East Smithfield I remember applying to the police office to restrain some man who charged 2s. 6d. for stamping three coal measures, the regular charge being 4½d.; he also made no comparison with the standards, in fact, he had no standards; all the weights and

O. 24. Mr. HAYMAN—*continued*.

measures stamped by this person laid the parties open to the penalties of the Act. But these irregularities were not only committed by persons holding no official appointment; I remember the Inspector [in a parish named by Mr. Hayman] received instructions from the parochial authorities to stamp in accordance with the 16th section of the Act, he did so by marking $\frac{3}{4}$ (the supposed ratio such weights and measures bore to the imperial.) He also made no comparison with the standards; and I well remember, when the parties moved into Westminster, Surrey, and other parts, the authorities then gladly availed themselves of the opportunity of seizing all such weights and measures, and inflicting a heavy penalty on the parties, who thought they had complied with the meaning of the Act. Under this Act I also remember there being no penalty; one measure-maker alone boasted of saving £50 per year by stamping his own measures. I also know these measures, thus stamped by unauthorised persons, were re-stamped under the late Act by the Inspectors of different counties, who thought the original stamp a sufficient proof of accuracy; I afterwards examined many of them, and found them vary from 1 to 2 quarts in the bushels, thus not only giving rise to disputes as to the measurement of goods, but rendering the parties liable to penalties.

Clause 6. This clause is extremely indefinite, and there is really no meaning in first determining that the "imperial" shall be the only measure, and then allowing the use of all sorts of customary measures.

Clauses 7 & 8. These two clauses, taken in connection, accomplish nothing; and goods are still sold by heaped measure. The use of the heaped bushel is abolished by clause 7, and restored by clause 8; no magistrate will act in this case, and it is well they will not, as it is perfectly impracticable to sell goods in the manner there laid down.

Clauses 10 & 11. Advantage is taken of these clauses by refusing the usual allowances for waste, upon the plea that every thing must be sold by 56 [112] to the cwt.

O. 25. *Prussian Laws*.

§ 10. For private use, and in the management of his own house, every person is at liberty to use unstamped weights and measures.

§ 11. But as soon as anything is anywhere delivered by measure or weight, either the deliverer or the receiver can demand that the delivery be made by measures and weights properly stamped.

§ 12. Whoever exposes for public sale any wares is to make use of no measures or weights but such as are properly stamped, and is even to have in his shop or booth no unstamped measures or weights. By transgression of this rule, even though no fraud have been committed, a fine (Polizeistrafe) of one to five thalers is incurred.

§ 15. After the lapse of eight months from the publication of this law, those measures only shall be considered stamped in conformity with the rules which are marked with the stamp of some inland stamping office; other stamps shall no longer receive attention.

§ 16. The exact form (ausgezeichnete Form) of this stamp shall be published as soon as the stamping-offices are erected.

§ 17. The stamping exonerates no one from the duty of taking care that his stamped measures and weights do not become inaccurate by use or accident.

§ 18. The public bodies and persons mentioned in sections 13 and 14 are especially bound, not only as often as they think that variation may have taken place, but also at least once a year in any case, to try the agreement of their measures and weights at the nearest stamping-office, and to cause their correctness to be attested for their legitimation, under penalty of a fine (Ordnungsstrafe) of five thalers.

O. 25. *Prussian Laws—continued.*

§ 20. For greater security to commerce, the following rules are established for the sale of certain wares.

§ 21. We will provisionally permit (vorläufig gestatten) the use of the hand-reel (Hand-haspel) customary in the different provinces. They must, however, be stamped by the stamping-officers, who are to determine what is the customary measure (von dem gebräuchlichen Maas in Kenntniss zu setzen sind). And the provisions of section 19 apply to persons who make use of unstamped or improperly stamped hand-reels for measuring off yarn for sale, (für den Handel). Manufacturers are permitted not only to use unstamped hand-reels of arbitrary size in their factories, but also to arrange, according to any arbitrary reel, the yarn which they cause to be spun out of their factories; so that it is free to any one to make use of arbitrary standards for the unreeling of yarn solely for his own absolute need. Also for yarn spun by machinery and without interruption (Maschinen-gespinnnet ohne Unterschied), every manufacturer may for the present use such reels as suit his convenience.

§ 22. In all building concerns in our states, only one measure of the rod, the foot, and the inch, shall be used in future; in particular, the use of the different Silesian, Cologne, &c., feet and inches shall entirely cease.

§ 23. In all mining concerns in our states, only the same fathom (Lachtermaass) shall be used in future; and the use of a different Silesian fathom shall cease.

§ 24. In land-measuring in our states, only those rods which are authorized in section 22 shall be used, and shall be divided into tenths and hundredths. The use of different provincial rods is to cease, and the names of decimal feet and decimal inches, which give cause of confusion, are to be no longer used.

§ 25. Stones, brickwork, faggots, earth, turf, and fire-wood, from the year 1817, in all transactions, and from the present time in all public sales, shall be estimated only by the cubic fathom (Klafter) of 108 cubic feet; and only the foot authorized in section 22 shall be used. Such a cubic fathom is a rectangular heap, 6 feet long and broad and 3 feet high or deep; meantime any other way of setting up the heap is permitted, provided that it gives the above written number of cubic feet. Every buyer may demand delivery according to this measure. It is the duty of the Police to demand the setting up of the materials above-named according to this rule, as far as they come to every one's public sale. Private persons and institutions, which collect or procure such materials only for their own use or fabrication, may nevertheless set them out according to their own convenience, as also in building work the common use of the Schachtruth of 144 cubic feet may still be preserved.

§ 26. Coopers shall hereafter deliver no new vessel, or old vessel altered by the insertion of new staves, in which wine, beer, vinegar, brandy, and similar fluids are sold, without branding upon it the number of Berlin quarts and their stamp. This stamp, which by single letters specially indicates the manufacturer, will be sent to him from the Stamping Commission of the Department through the local police, for mere reimbursement of the expense. The local Police is to take care for the recovery of this stamp, as soon as the cooper gives up business.

27. For the simple omission of the marking above described, coopers incur a penalty (Polizeistrafe) of one thaler for every unstamped vessel. Vessels which are found to be incorrectly branded they must without recompense mark over again, and they also forfeit the value of the vessel as a penalty. It is also left to the decision of the body of police, according to the circumstances of the case, to apply for the institution of criminal process, and for weighty offences to take the stamp from the offender.

§ 28. All bottles made in inland glass-houses must there be marked with a stamp, which, near the mark peculiar to the glass-house, expresses the content in Berlin quarts or fractional

O. 25. *Prussian Laws—continued.*

parts. The proprietors of the glass-houses receive these stamps, on payment of the expense merely, from the Stamping Commission of the Department, through the local police, which is bound to take care for the return of the stamp when the glass-house is given up.

§ 29. For the simple omission of the stamp mark, a fine of two groschen is incurred for every bottle. Bottles whose content differs from the quantity marked by the stamp more than one sixteenth part, must be returned to the glass-house, and the sale price and the expense of carriage must be paid [by the proprietor of the glass-house].

§ 30. From Jan. 1, 1819, every purchaser of beer, wine, vinegar, and brandy in bottles, can demand the delivery of these articles in bottles stamped in conformity with section 28.

§ 32. Goldsmiths and silversmiths will receive their stamps (which are necessary, in conformity with the existing laws, to mark the degree of fineness of gold and silver ornaments and wares of all kinds, and to show the maker's name) on payment of the expense only, through the Superintendants of Local Police, from that Stamping Commission which is established in the principal town of the Province, where the Presidency (Oberpräsidium) has its seat. The Superintendants of Local Police must take care for the return of this stamp when the goldsmith or silversmith leaves off the exercise of his trade.

§ 33. Every buyer of gold or silver work is authorized to refuse it, if it is not provided with the stamp here described.

O. 26. *Prussian Law Instructions.*

§ 27. In all public transactions no other measures and weights shall be applied throughout the Prussian states.

§ 28. Even for private business in the old departments of the Mark and the provinces Pomerania and Prussia, no other measures and weights shall be considered worthy of stamp.

§ 29. On the other hand, (in the districts which have been already added to these provinces through the new division of the state, as well as in all other parts of the state not before-mentioned, where private traffic requires, together with the above-mentioned measures and weights, the use of peculiar provincial measures and weights,) this usage of private traffic shall for the present be still permitted. But the proportions of these provincial measures and weights to the legal ones must be accurately ascertained by the proper authorities, and must be delivered in to our Board of Finances and Commerce for examination; the just proportion must be made known to the public; and, in the next place, each of these measures and weights must be stamped by the proper stamping-offices.

§ 30. Any provincial measures and weights, other than those whose usage is hereby permitted for the present, cannot be stamped.

§ 31. The original measures and weights, which are to be constructed in conformity with section 1 of the Weights and Measures Ordinance of this day's date, and which in future are to be the sole foundation of the whole system of Prussian weights and measures, are to be constructed solely and exactly according to the preceding rules, and the proportions here determined to be lawful, without regard to any measures and weights which may formerly have been used as normal measures and weights any where in the Prussian states.

O. 27. *Mr. REEVES.*

No local or customary weights or measures have been recognized as legal since the passing of the Act of the 5 and 6 Wm. IV., cap. 63; but the inefficiency of the Act is so great, that there is little doubt of its provisions being much disregarded.

O. 28. Mr. REEVES.

Equalization of weights and measures throughout the kingdom is most beneficial, and it would be desirable no future enactment should revive any such customary weights or measures, and that instead care should be taken, that it should be a part of the duty of the Inspectors to prevent any evasion of this most important clause.

O. 29. Mr. REEVES.

It appears desirable that some regulation should be made respecting the examination and stamping of the weighing-beam, without which none should be offered for sale. As far as the respectable and conscientious part of the weighing-beam makers is concerned, there is no doubt of the general accuracy of their manufacture, but the sale of weighing-beams and scales is by no means confined to such persons. There is a very common practice among the inferior class of shopkeepers, upon filling up their premises, to apply to general furnishing brokers, who supply them with all requisites, including weighing-beams and scales, weights, &c.; a great proportion of such beams are old ones, painted and varnished for sale, or made by persons little scrupulous as to their correctness. The weighing-machines used in the coal trade in London, are examined and stamped at the City of London Stamping Office, before they are allowed to go forth for public use; can there be any objection to all weighing-beams and machines being subjected to like proof of their original accuracy? And if a penalty were to be incurred by persons selling any weighing-beam, unless they knew the same to be of just balance, it would act as a check upon the sale of such incorrect beams.

O. 30. Mr. REEVES.

The inefficient manner in which weights, &c. in use are tried by Leet Juries, is much to be complained of; another inconvenience arises from the confusion of parishes having a right of stamping. And the use of the wooden measure for dry goods, which appears very objectionable;—first, from the manner of filling the measure admitting of great deception being practised, and from the difference which always occurs when the measuring takes place upon a solid floor, or upon the flooring of a loft, or any place hollow underneath. Secondly, from the variation the measure is liable to from the action of temperature; and thirdly, from the very slight and imperfect manufacture of the second-rate class of measures, which allows of alteration being made to considerable extent, without the possibility of detection, except by comparison with the standard measure. The variety of the form of weights appears undoubtedly objectionable, as also the extent of the surface of lead used in capping, which admits of much liability to alteration by persons dishonestly inclined.

O. 31. Mr. REYNOLDS.

Suggestions for new enactments:—

To make the Act perfect there should be an uniformity in the weights and measures throughout England, &c. There should be but one method acted upon to examine weights, &c. All Leet Juries discharged, the necessity of which I shall be able to prove before the Committee. All local Acts should be abolished, and there should be a Commissioner and Receiver-General appointed to receive all fees, and pay all expenses of the working of this Act. There should be a sufficient number of Inspectors and stations for stamping in every county. Every person should have their weights stamped once every year, and have a certificate of reverification. Every weight, &c. should be stamped with the county stamp, with the date of the year thereon. No weight should be stamped by any Inspector unless it had a *perfect cap*, which is of great importance. Every tradesman should make a return every year of all weights or measures kept or used by him in his business.

Every constable, or other peace-officer, should be authorized by this Act to enter any shop,

O. 31. Mr. REYNOLDS—*continued.*

store, &c., within his jurisdiction, and examine weights, &c.; and if found to be unstamped, to seize the same, and give information to the Inspector of the district, who should summons those persons before the magistrates.

Any person whatever who shall alter any weight or measure after they have been stamped as aforesaid shall be liable to the penalty of

All persons using false balances of any description, shall be subject to have them seized either by the Inspectors or constables as aforesaid, and if proved to be unjust, the same to be forfeited and fines levied. The Inspectors should attend before the magistrates to prove (in all cases) whether such weights, measures, or balances are illegal or not. The fees for stamping a yard measure should be two-pence, instead of one halfpenny.

I feel satisfied that if an Act of Parliament was framed with the provisions I have recommended, it would put a stop to many frauds I have been in the habit of witnessing, and would render a great benefit to the community, in addition to bringing in a revenue that would far exceed all expenses. The fees in Middlesex alone, if all the weights and measures were stamped at the present low scale of fees, would amount to two or three thousand pounds annually.

O. 32. *Sardinian Laws.*

§ 38. All those who make use of weights and measures for selling publicly goods of any kind, or for buying them in the way of traffic, as well as apothecaries, public weighers, money-changers (*cambisti*), and the receivers of public tolls, ought, within six months from the publication of the present law, and after the notification of the name of the standard-man in those provinces in which he has not yet been named, to present to the standard-man of the province their weights and measures, to be examined and marked; and thus successively every year, in the first six months of each year.

As to the delicate balances for gold and precious stones, and for the use of apothecaries, the annual examination will take place as for all other balances; but the standard-man will mark them only once in three years, and the same with regard to their weights when they admit of it.

§ 39. At the first of these verifications, the weights and measures in the possession of the aforesaid persons are to receive the inscription, expressing the nature and value of the same (prescribed in Art. 30 for weights and measures which are to be adjusted), wherever it has not been already applied; and the standard-man cannot mark the aforesaid weights and measures, unless the inscription be already applied, or unless he immediately apply it himself, whenever they admit of it.

§ 40. Innkeepers and others selling wine and liquors, oil, and other liquids, by retail, shall be obliged to keep continually in sight of all comers, at least one of every kind of measure of glass, earthenware, or porcelain, of which they make use, examined and marked, and which they are to employ for the sale of wines and liquors when required by the purchasers; for these measures the annual examination shall take place, but the mark of the standard-man shall be affixed only once. The measures of pewter and tin are, however, to be verified and marked annually.

§ 41. One month before the expiration of the terms already fixed (either for the first and general examination and marking, or for the successive ones), all those who keep for the purposes of trade balances and steelyards fixed in walls or otherwise placed in their shops and magazines, as also the possessors of steelyards (*a bilico*) and others adapted to heavy loads for public use, are to give notice of them to the standard-man, indicating at the same time the quality of the balances or steelyards and their precise situation. The standard-man ought to

O. 32. *Sardinian Laws—continued.*

go as early as possible to the place indicated, in order to proceed with the examination and mark.

§ 42. Persons of the classes above-mentioned who omit to present for examination and marking their weights and measures within the time prescribed, and those who omit to make the declaration as to fixed balances and steelyards, shall incur a fine of 10 to 25 lire, according to the circumstances of the case; for the payment of which shall be personally bound (*tenuti in proprio*) the administrators, tutors, and trustees, for the cities, communities, colleges, pupils, and persons intrusted to their care.

§ 43. The same punishment shall apply to those who use marked weights, which have afterwards become inaccurate; if they shall have been used fraudulently, the penalty shall be increased to 100 lire, besides the punishment prescribed by the laws for the crime of fraud.

§ 44. The persons mentioned in Art. 38, who shall become possessed of measures and weights which have not been examined and marked by the standard-man, ought, before using them for their traffic, to submit them to the said examination and mark. The same shall hold if the mark of the standard-man does not bear the impression of the year in which the acquisition of the aforesaid measures and weights has been made, or if (with regard to delicate balances) the three years have elapsed.

§ 51. For infringements of the present Regulations, where there is no particular punishment already established, the persons infringing shall incur a fine of 10 to 15 lire, according to the circumstances of the case.

§ 52. With regard to the process and cognizance of infringements, the disposition of the Royal Edict of 27th September, 1822, shall be followed. Those infringements, however, of the present Regulations, which are subject to the punishment of suspension or interdiction, shall be under the immediate cognizance of the Magistrature of the Chamber of Finances.

§ 53. No innovation is made in regard to the jurisdiction of weights and measures belonging to the Governor's office (*Vicariato*) of this city.

§ 54. The present law does not repeal the manifestos of the Chamber of 28 June, 1817, and 24 March, 1819, and other provisions relating to weights and measures, except in those parts in which new dispositions are made by the present Regulation.

§ 55. Whatever tax has been imposed on account of the cities or communities, for the marking of weights and measures, is to cease at the instant of publication of this Regulation.

Then follow tables :—

Of the payments for comparison and stamping (*bollo*) of measures, weights, and balances.

Of the payments for adjustment.

Of the errors allowed.

O. 33. Mr. WADE.

In answer to your letter, I beg to state, that when I first read it, I thought that tradesmen might be legally allowed a trifling error in their weights and measures. But on seriously considering of it, I am decidedly of opinion that it would be a very great evil; for instance, if a hundredth part should be legally allowed, there are many tradesmen that would take advantage of it, and have their weights and measures made so much deficient; in that case they would never be correct. But still I think tradesmen should not be fined for a very trifling error, if it occurs in fair wear without intent of fraud, as iron weights in use with butchers, porkmen, oil-shops, and several others, which come in contact with salt and brine, if correct to the standard when stamped, would not remain so one month; therefore if Inspectors were allowed to stamp tradesmen's weights, say $\frac{1}{4}$ ounce in 50 lbs., $1\frac{1}{2}$ dram in 10 lbs., and so in proportion with iron

O. 33. Mr. WADE—*continued.*

weights, and just the turn of the scale in brass weights, but not allow 1 grain deficient, I think, practically speaking, the system would work very well. With respect to convictions before Magistrates, I never brought a case before them that was trifling or vexatious; and they have always convicted without allowing of any error. As relates to balances and other weighing-machines, they ought certainly to be an even balance, as any degree of draft legally allowed, would cause many disputes, and it is less trouble to keep them even than with any degree of draft, and I am certain the Magistrates would not convict for a trifling error unless it appeared intentional. With reference to dry measures, as the bushel, the gallon, &c., being made of wood, they will vary according to the atmosphere; my opinion is, that when new, they ought to be left full, say $\frac{1}{2}$ gill in the bushel, and the rest in proportion; I think all these errors ought not to be legally allowed, but left to the Inspector, as nothing but practice will prove the necessity of it.

O. 34. Messrs. WARNER.

We consider it would be impossible to stamp beams, machines, or balances, so as to be of any use; the very act of stamping a beam would destroy the correctness of it; formerly coal-weighing machines were stamped, but the plan was found to be useless, and is now discontinued; in the late Act of Parliament that clause was omitted, we believe. It is always in the power of the Inspector to test the correctness of any beam or machine, by placing equal weights in the scales; and it certainly should be the duty of an Inspector to try all beams, machines, &c., when he is examining the weights and measures.

All spring balances, in our opinion, are very objectionable, as they are much more liable to variations, from a variety of causes which cannot be guarded against (such as change of temperature, &c.), than beams or machines constructed on that principle.

We are also of opinion, that no deficiency in weights or measures ought to be allowed by law, but it must always be left to the discretion of the Inspector, or local authorities, who would easily detect any intention to defraud. Any legislation on that point, or on the sluggishness of beams, we think would be worse than useless. Weights sold by us for common purposes in the country, are stamped at Founder's Hall, those for London are stamped at Founder's Hall and Guildhall, and all measures for town or country, are stamped at Guildhall only.

O. 35. *Westminster Review.*

Recommends that the size of bottles be regulated by law, and proposes a scale founded on the weight of water which they would hold, beginning with 10 ounces.

O. 36. Messrs. WHITBREAD & Co.

In answering your inquiries, we have endeavoured, as far as possible, to divest ourselves of the prejudices which consideration of our own interest would naturally create. In this endeavour we are not quite sure that we have succeeded, for we have escaped so recently from the intolerable evil of having our business constantly subject to the interference of the exciseman, that we cannot but hear from you with the greatest regret that any idea is entertained of putting us under the supervision of a cask inspector.

In answer to your first question, whether the proposed plan would really give the desired security to the transactions between man and man, we should say decidedly, no; for this reason, that the cask must be empty at the time it is examined, as the contents cannot be ascertained correctly in any other way; and that therefore the fraudulent dealer has it in his power to change the measure of the cask, by a stroke or two of his hammer, to the extent of at least half a gallon in the butt, before it is actually filled.

O. 36. Messrs. WHITBREAD & Co.—*continued*.

Your next question is, what would be the amount of the inconvenience to the different parties. We would submit that the extent of inconvenience would be incalculable. The plan, to be effectual, must be based on a system of penalties, and must encourage the existence of common informers. It would operate, we think, still more harshly on the small brewer, than on the proprietors of the larger establishments. From the immense extent of our business it would be necessary to have the cask inspector constantly on our premises; but in the case of breweries of much smaller size this would not be so, but the brewer would be placed in the dilemma of being obliged either to violate the law, and thus lay himself open to the attack of the common informer, or he would be unable to execute an order until he has succeeded in procuring the presence of an Inspector, whose residence may be at a considerable distance.

O. 37. Messrs. WHITBREAD & Co.

The principal brewers of London are in the habit of manufacturing a very large proportion of their casks. For our own parts we have not bought any butts, and but very few puncheons, for the last ten years.

You inquire how many years upon an average will a cask last. We answer that this depends a good deal upon the size of the casks, for we find that our butts do not last more than fourteen years (say $7\frac{1}{2}$ per cent. of the stock are worn out annually), while the puncheons last twenty-four years (say $4\frac{1}{2}$ per cent. worn out), the wear being greater in the former case than in the latter, on account of the difference in the weight (and perhaps also of the pressure) of the contents, while the thickness of the material is in both cases the same.

The cask-maker (whether brewer or not), measures by means of a rule, taking the height standing, and the diameters of the largest and smallest parts of the cask. Should any irregularity in the shape give cause to suspect that the measurement does not give a correct result, the cask so suspected is measured by filling it with a gallon measure.

You ask how many new casks per annum are required for a London brewery. We find that on an average, our butts and puncheons are filled about five times in the year. Suppose the trade of a London brewery to be 200,000 barrels per annum. A stock of casks containing one-fifth of that quantity will be required, say 40,000 barrels. Supposing that of this quantity, one-fourth, 10,000 barrels, is contained in puncheons, 5000 of this description will be required; and $4\frac{1}{2}$ per cent., or 225 new puncheon casks, will be necessary to keep up the stock. The other three-fourths, or 30,000 barrels, being contained in butts, will require 10,000 butts, and $7\frac{1}{2}$ per cent., or 750 new butt casks, must be wanted every year.

We take the opportunity of stating again our conviction that as the size of casks may very easily be altered by design or accident, any measure for causing casks to be marked with their supposed contents will be inexpedient, and we will venture to add, unattended with the desired result.

O. *1. Messrs. BARRETT & CLAY.

The following are the sizes most in use, and you will perceive that they do not differ much in size, particularly the two last, which are used by all respectable merchants in the trade:—

		Contents in distilled water each.	
		lb.	oz.
No. 1, known by the bottle-merchants as small 4's, $5\frac{3}{4}$ to a gallon	. . .	1	$11\frac{1}{2}$
No. 2,	" " " 5's, 6 " when the	1	11
quantity to make room for the cork is thrown off	. . .		
No. 3,	" " " 5's, 6 " full to the	1	$10\frac{1}{2}$
top	. . .		

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O. *1. MESSRS. BARRETT & CLAY—*continued*.

No. 2 is what we use, and what is generally used, if possible; but even these sizes vary very much in the manufacture; but, if true, six of them would contain 2 oz. of water more than the gallon. Presuming 1 quart imperial measure to weigh 40 oz., this would give 160 ounces to a gallon; and six of these bottles (No. 2) should contain (if it were possible to manufacture them correctly) 162 oz.

There is a larger size used for ale, &c., called

	lb.	oz.
4's, 5½ to a gallon . . .	1	13½

We have consulted our bottle merchants as to the practicability of manufacturing bottles of a certain size, so as to be perfectly true to the measure; and it does not appear, according to the present system of manufacturing them, to be practicable. Much depends upon the skill of the blower as to the thickness of the glass; and of course, if a bottle of a certain size is blown a little thicker than usual, it will contain less liquid. In drawing out the neck also, the shoulder may be a little more or less bowed, which would make a difference.

We should mention that the Customs recognize, in calculating the duties and drawbacks upon wines in bottles, six bottles to the gallon.

The Excise take the duty upon bottles by weight, at per cwt., and in weighing several gross of the same-sized bottles, the weight is often found to vary considerably, showing the impracticability of making bottles to a true size.

O. **1. MESSRS. BARRETT & CLAY.

In reply to your question, "What would be the inconvenience of requiring that all wine-bottles manufactured in future should bear a stamp, denoting that they had been examined by some competent authority, and had been found to contain the quantity which at the present time they are understood to contain, with fair allowance for the difficulty of manufacturing?"—We think that great inconvenience would arise first to the merchant and consumer of the wine already bottled and to be bottled in *unstamped* bottles. To the *merchant*, because the consumer would look with suspicion upon unstamped bottles, and would in many cases refuse to buy wine in such bottles; and to the *consumer*, because the merchant would in all cases refuse to take his old bottles back as they are emptied, on account of their being *unstamped*. The stock of bottles, both old and new, must of necessity become deteriorated in value by the introduction of the stamp, on account of their not having that verification of their contents; and it is not possible to stamp bottles after their contents are measured. The stamp must either be in the mould, or they must be stamped while the metal is soft; and in that state not being annealed, of course the measure of the contents could not be obtained. If the stamp were made in the mould, the bottle would rarely correspond in its contents (when measured) with the stamp, and consequently must be destroyed; which would be an enormous loss to the *manufacturer*. It would certainly be desirable if bottles for wines and spirits could be made to one standard of 6 to a gallon, but not stamped, as it would save the bottle-merchant the trouble and expense of having every bottle which he receives from the manufacturer measured to ascertain its contents. But this cannot be done by the present process of manufacturing bottles. It is the object of the glass-blower to make his bottles all of one size if possible, and the mould for all reputed quart bottles is, or ought to be, one size in every manufactory, so that the difference in the size of the bottles is not intentional. There are many causes for the difference; the blower may take more or less of the fused metal on the end of the tube than is necessary for his bottle, and he may blow it in the mould either too much or too little, which would make the glass thinner or thicker. The mould comes up to the shoulder of the bottle only, and sometimes the

O. **1. MESSRS. BARRETT & CLAY—*continued*.

metal adheres to the sides ; consequently, when the workman draws out the metal to make the shoulder, he sometimes elongates the straight part of the bottle, and of course that will make it both higher and thinner. Then (as we mentioned before) the shoulder may be more or less bowed ; and besides these errors, the *push*, as it is called, at the bottom of the bottle, may be pushed in too much or not enough ; the bottom in the mould is of this shape, and it is pushed in afterwards by means of a conical mould ; this would alter the contents of the bottle. Sometimes throughout what is called by the workman a “journey,” or day’s work, he will make all his bottles too large or too small, and it requires great attention on the part of the overseer to prevent this. The division of the bottles into 5’s, + 5’s, &c., is made by the bottle-merchant, every bottle he receives being rinsed in hot water, filled, and then started into a measure with rims at different heights, thus indicating the size of the bottle. The merchant finds a great number of bottles amongst those he receives below the standard of 6 to a gallon, and these are used for exportation from the docks, by those who export largely, to compensate for the low price to be obtained. It would be desirable for the home trade if this bottle could be done away with ; but it would be a serious loss to the manufacturer. There is a bottle manufactured called a “patent bottle,” this is blown in an open-and-shut mould, which forms the shoulder also, and this bottle is flat at the bottom. They are neater in appearance, but vary very nearly as much in size as the others, and besides are objectionable for Port wines, as the crust of the wine slides off them.



O. 2*. MR. BIDDLELL.

You are right in supposing that the price of corn does not vary in the same proportion as the weight, supposing all other things alike in the corn (as the denomination of white or red, the place of growing, &c.) If wheat weighing $18\frac{3}{4}$ stones to the coomb be worth 38s., wheat weighing only 17 stones to the coomb is not worth more than 33s., as the lighter wheat will have the greater proportion of bran. There are so many things operating upon the price of different samples of grain that no invariable rule can be laid down. Neither weight nor measure taken alone is a criterion of value ; colour, condition, the sort of wheat, &c. &c., are taken into calculation in the purchase. The advantage of having corn sold by weight, will be more to insure a fair delivery than for any other purpose. It cannot be so uniformly or so correctly measured as it may be weighed ; so many things will affect the measure that will not in any equal degree affect the weight. When corn first comes from the threshing-floor, it measures to a greater quantity than at any other period ; from that time it is made more smooth by friction in carriage and otherwise moving it. When laid upon a chamber, the state of the atmosphere will also affect the measure, sometimes increasing and sometimes diminishing the bulk, according to the condition in which it is deposited. Weighing would therefore be more desirable than measuring ; but this advantage will have no inconsiderable set-off in the convenience of measuring over the trouble of weighing.

O. 4*. MR. CLAXTON.

All grain (malt and barley for malting purposes excepted) is sold by weight in this market (Liverpool.) There is no inconvenience attending it, and I conceive it to be not only a much more equitable mode, as between buyer and seller, but one which is far less liable to cause disputes about quantity, than when sold by measure ; hardly any *two* measures will produce the same result in measuring a given quantity of corn.

Wheat is sold by . . .	70 lbs. weight
Oats.	45 „
Barley (for grinding) .	60 „

O. 4*. Mr. CLAXTON—*continued.*

I find that the Inspector's duties are defined by the Act 31 Geo. III. c. 30, and the calculation is thus made. The Winchester bushel is there made to weigh

Of Wheat	57 lbs.
Barley	49 „
Oats	38 „
Rye	55 „

The Inspector first reduces the weight, by which the grain is returned as sold here, into Winchester bushels; he then brings it into Imperial measure, by deducting $\frac{1}{31}$ part from the number of Winchesters (the Imperial bushel being to the Winchester as 31 to 30); this quantity is again divided by 8, to bring it into Imperial quarters. The amount of money for which the grain was sold is then divided by the number of quarters, and the produce is the result, which is sent to the receiver of Corn Returns in London.

The statement will perhaps be best understood by exhibiting the process in figures.

The merchant makes his return to the Inspector here as having sold $101\frac{0}{70}$ bushels of wheat at 10s. 6d. per 70 lbs. = £53. 0s. 6d.

$101\frac{0}{70}$	
$\frac{0}{70}$	$\cdot 31$
75) 7070	(124 Winchester.
57	4 as 31 to 30, to bring it into Imperial
137 8	) 120 Imperial bushels
114	
230	15 Imperial quarters, at 70s. 8½d. = £53. 0s. 6d.
228	
2	

The return is then sent to London as "15 quarters of wheat sold for £53. 0s. 6d." (or equal to 70s. 8½d. per quarter.)

Now to show the unfairness of this parliamentary mode of calculation it is only necessary to state, that wheats of a quality to bring the price of 10s. 6d. per 70 lbs., must weigh at least 60 lbs. per Winchester bushel. The correct return would therefore be about 74s. 2d. per quarter instead of 70s. 8½d.

An Imperial bushel of *fine* wheat will weigh about 63 lbs. or 64 lbs., whilst much of the last year's of Irish (which is also included in the returns) will not weigh more than 53 lbs. or 54 lbs. Fine oats will weigh 42 lbs. or 43 lbs. per Imperial bushel; good ones 40 lbs. or 41 lbs.; ordinary 36 lbs. or 38 lbs. Fine barley 55 lbs.; good 52 lbs.; ordinary 48 lbs. or 49 lbs. per Imperial bushel. Rye about 54 lbs. or 57 lbs.

The price of grain does not vary in *exact* proportion to the difference in weight, because there are other circumstances to be taken into consideration in estimating the value; such as colour, condition, soundness, &c. &c., but of course the weight of the grain is one of the best tests of its goodness. A bushel, of 70 lbs., of the best *white* wheat is now worth 10s. 6d., whilst a bushel (70 lbs.) of the best *red*, of equal weight per Imperial bushel, is only worth 10s. The lowest useable quality of Irish is worth about 8s. per 70 lbs., weighing about 54 lbs. to the Imperial bushel.

I think I have before stated to you, that the mode of selling corn varies in almost every market in the United Kingdom. In England we have lasts, quarters, bolls, coombs, windles, Carlisle bushels, and I know not what besides. In Scotland bolls and firloths, which vary in weight and measure in almost every district. In Ireland I believe they invariably sell by weight only.

O. 5*. MR. DE GRAVE.

It is my opinion (and that after much consideration) that not the least allowance for error and incorrectness ought on any account to be allowed by Act of Parliament, either in weights, scales, or balances belonging to tradesmen. It is true the weights will get a little light, and balances will get incorrect by use, but it is the duty of the tradesman or owner to guard against that, and which every person can easily do. Inspectors ought to be persons who can discriminate between tradesmen that wish to do what is right and correct, and those who act otherwise; if the Inspector finds a trifling incorrectness (so trifling that no fraud could be intended), he ought to warn and caution that person, and very soon afterwards pay him another visit; and if that incorrectness remained, then it is my opinion that person ought to be taken before a Magistrate, and fined quite as much as if intention of fraud had been proved, although the error might have been but trifling, because that tradesman did not avail himself of the opportunity that was afforded him. Weights vary very much according to the trade and also from exposure to the weather, which allowance I think could not be made by Act of Parliament; a little conversation on this particular would throw much light on the subject.

At present balances are not stamped, and in my opinion it would be impossible to carry out such an arrangement, and even if it were possible, no good whatever could arise from it. Coal machines that were used within twenty miles of London, were formerly stamped at the Guildhall of the City of London, and after some years' trial the clause for stamping them was omitted in the recent Act of Parliament, and now none are stamped. Many were stamped as being just and correct (and were so at the time), but had they been examined even the next day, they would have been found unjust and incorrect, and that arising from bad workmanship; and the operation alone of stamping beams would make them incorrect. A sluggish beam or balance would be against the tradesman, as it would require more to turn it, and therefore the tradesman would give more than weight. It is my opinion that the Inspectors should try all scales and balances as well as weights, and that would be the best protection to the public, far better than that of stamping, even if the stamping was practicable; a stamp on a weight only shows that it was *once* correct, and that is all; but the Inspector trying them proves the correctness at the time. In France great attention is paid to stamping weights, and I believe more so than in any other country; yet I never saw a correct set of French weights. It is my opinion that no person or tradesman buying or selling by weight should be permitted, on any consideration, to use any machine or balance unless legal and proper weights are used with them; many are now used with only figures, and others of different descriptions of springs, all of which are incorrect and very objectionable, and although I condemn them, yet I sell them because others do, and they are allowed. I sell many weights unstamped; all weights that are required to be very correct are never stamped; a blacksmith might as well attempt to make a watch, as Inspectors to adjust weights for many purposes. Much of the protection that is due to the public and also to the tradesman depends on the Inspectors, and Magistrates ought to be in frequent communication with them, and they would soon find out the litigious from the faithful servant. Unless intention of fraud is perceptible, the Inspector ought only to warn or caution, as stated before.

O. 24*. MR. PELLATT.

There is no difficulty in stamping glass bottles either by moulding or sealing; the former is frequently done in 6 oz. or 8 oz. bottles, to show the division of each bottle in three, four, or six parts or doses; the latter is practised on larger bottles, such as two-quart bottles used by the Navy for lemon acid, by simply dropping a small piece of hot glass, and sealing it while soft, prior to the bottle being placed in the annealing arch; for the process of one kind of moulding I refer you to No. 582 of the 'Penny Magazine.'

O. 24*. Mr. PELLATT—*continued.*

In either case the limit of uncertainty would be great; probably in pints and quarts, and indeed any sizes larger or less, in the proportion of about $\frac{1}{16}$ to $\frac{1}{8}$; from the common quart bottles blown as one size are picked sizes, as various in content as 13 up to 16 to the 12 Imperial quarts, but such sizes can only be selected when cold by measuring every bottle with water.

All bottles that could be made in open-and-shut moulds (see No. 582 'Penny Magazine' page 85) would incur no additional cost for marking, but the stamping or sealing (of other kinds of moulded bottles, or bottles made by hand) would cost additionally about 2s. 6d. per gross.

As to the degree of inconvenience (as far as I am concerned, which is chiefly in medical bottles, stopped and unstopped), I can scarcely estimate it; the loss of time, expenses, and hindrance to business, would so harass a manufacturer as to make it almost impossible to conduct his business.

The cause of variation arises from the difficulty of gathering one uniform weight of metal; also with the greatest practice, from the thickness of metal being often greater in one part of the bottle than another (and although there could always be the same quantity of metal), a variation of contents would thus be caused; indeed, the accuracy required for Excise inspection cannot be secured by any process of manufacture with which I am acquainted after an experience of above thirty years.

With regard to earthenware or stone, nearly the same difficulties would be experienced; and it appears to me that the object wished to be secured, of identical or uniform accuracy of contents in glass or earthenware, is entirely impracticable.

O. 31*. Mr. REYNOLDS.

I never seize $\frac{1}{2}$ -cwts. unless they are $\frac{1}{2}$ an oz. short, $\frac{1}{4}$ -cwts. above $\frac{1}{4}$ oz. short, 14 lbs. $\frac{1}{4}$ oz. short, but leave them with the shopkeepers, on condition that they have them adjusted and stamped in the course of a few days; and all smaller weights I seize if not standard weight except the difference is trifling. I think it would be bad policy to make any allowance (*by Act of Parliament*) for wear and tear; it would open a door for fraud; the dishonest dealer would have all his weights made light as far as the allowance went.

At present the Inspector uses *his* discretion on examination; next the *Magistrate*, when he hears the case, whom I never knew to inflict a fine for a weight, &c. of small deficiency, unless they were accompanied by some very bad ones.

In the stamping of new or repaired weights brought in by scale-makers, it is the invariable rule to bring them full weight, that is, to have the turn of the beam; and in $\frac{1}{2}$ -cwts. or $\frac{1}{4}$ -cwts. to allow two or three drams; 14 lb. weights, not exceeding two drams; 7 lbs. not one dram; which is quite sufficient for common wear and tear for two years, unless in shops where vinegar and salt is much used or sold, in which case they ought to be examined frequently.

With respect to what absolute error or what degree of sluggishness ought to be permitted in tradesmen's balances, my opinion is, that in all cases where scales are fixed or hung on counters, and weights kept in the pans, there should be allowed a draught of $\frac{1}{4}$ oz., as the public expect to see the scale with the purchased article go down, which is my practice to allow, but that all *hand scales* should be a decided balance.

With respect to measures of capacity, I do not think there is any necessity for making any allowance whatever, particularly in liquid measures, as the larger measures are generally made of copper and not liable to alter. The smaller measures are made of pewter, which being a soft material are more likely to wear, yet no allowance ought to be made, as it is the duty of the publican to keep the measures stretched out after being cleaned. If a pint or a quart pot

O. 31*. Mr. REYNOLDS—*continued.*

is really the *true standard*, the public *on all occasions* receive at least one-sixteenth part short measure. Suppose the measure itself is bruised in any way, which is too often the case, it will most likely be $\frac{1}{16}$ th short of the standard measure, which will make it in the usual way of business $\frac{1}{8}$ th deficient, a difference to the publican of thirteen and a half gallons in one butt of beer.

In wood measures of one bushel, half-bushel, and peck, there ought to be allowances made, as they are much liable to variation. I should not think of seizing a bushel unless more than half a pint short, and so on in proportion, but should leave them with orders for alteration previous to my next visit; of course if they were not altered the second time I should seize them.

I beg to remark, that if any alteration should take place in the Act, it is quite necessary that all wood measures should be of the same shape, which is not now the case; and also with respect to a *general warrant* under this Act, there is much difference of opinion on the subject of its legality.

My observation *that all wood measures should be of the same shape as the standards* arises from the great difficulty of ascertaining the contents; in testing wood measures that do not hold water it is necessary to use *rape seed*, which we place in a large funnel from the standard measure and then let the seed gradually fall from the *hopper* into the measure, which cannot be done so accurately if the bushel measure is not of the same shape as the standard; I think the difficulty would be entirely removed by providing a gauging scale for the purpose, and would be much better than either water or seed for wooden measures of capacity.

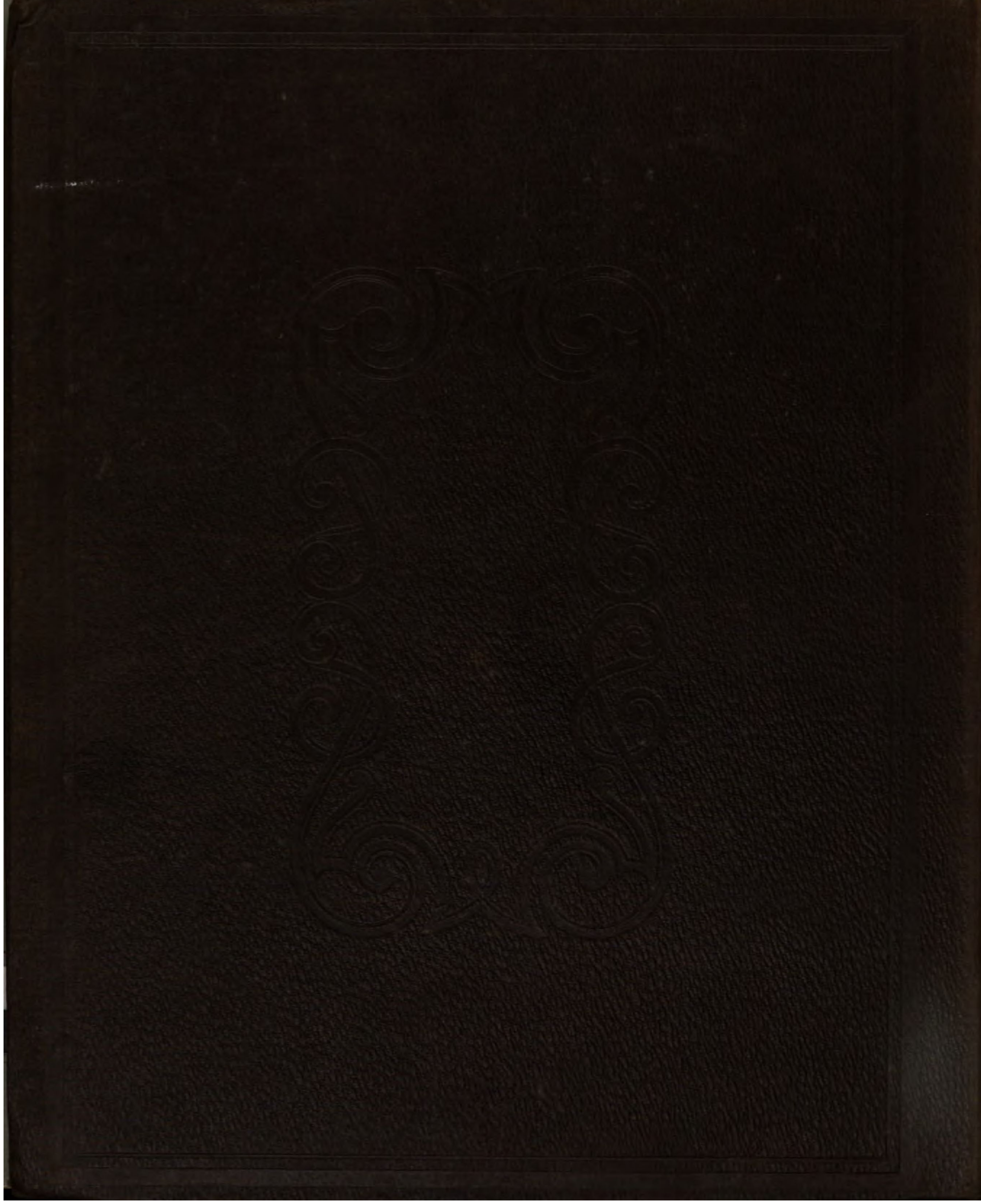
I beg to add that no wooden measures should be legal of less than a quarter a of peck, they ought to be of some metal, and I find more frauds committed with small wood measures than with any other.

I have had numerous complaints of short measure in 9 gallons of beer supplied by brewers; if all beer casks that are used for sending out beer to customers were stamped, it would bring in a *large sum*, and I do not see why a person selling a barrel or butt of beer, should not have his measure stamped as well as the publican who sells by the pint.

O. 33*. Mr. WADE.

In my last letter on the subject of balances I forgot to mention that there are now in use a great many spring balances, or steelyards, with dial plates and indexes, that are used without weights, which, if legalized to buy and sell by, will be the cause of much fraud, as the spring may be very easy altered.

THE END.



Airy, George Biddell,

Extracts of papers printed and manuscript, laid before the committion
appointed to consider the steps to be taken for restoration of the
standards of weight and measure, and the subjects connected here with

London 1840

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